Electrical World

McGraw-Hill Company, Inc. New York, July 20, 1918 15c a copy

Engineering Library

JUL 22 1918

UNIV. OF MICH. LIBRARY

WHO'S WHO

amongst the Prominent Customers of

Ward Leonard

IT is a significent fact that most of the prominent manufacturers and users of electrical apparatus are *regular* customers of Ward Leonard Electric Company, manufacturer of vitreous enamel insulated resistance units, motor field rheostats, motor starters, motor speed controllers, dynamo controllers, circuit breakers, battery charging rheostats, theatre dimmers, and other forms of controlling devices.

Ward Leonard Electric Company
Mount Vernon New York

THE DOMESTIC ENGINEERING CO. MAKERS OF DELCO LIGHT PRODUCTS DAYTON, OHIO, U.S.A.

VARIOUS GOVERNMENT DEP'TS

GE

AMERICAN TELEPHONE & TELEGRAPH CO. LOCAL AND LONG DISTANCE TELEPHONE BELL SYSTEM AND ASSOCIATED COMPANIES

Dyneto

MARCONI

Thomas A Edison Electric Light Plants

POSTAL TELEGRAPH INDEPENDENT COMPETITIVE PROGRESSIVE COMMERCIAL CABLES

GOULD "SIMPLEX" SYSTEM

BLACK SWAN

Weston

DYNAMOS-MOTORS WESTERN ELECTRIC COMPANY CABLES-TELEPHONES-SUPPLIES

ALL TRAINS VIA WASHINGTON BALTIMORE & OHIO R.R. LIBERAL STOPOVERS

SPLITDORF

PENNSYLVANIA SYSTEM

W WESTINGHOUSE ELECTRIC

SWARTZ

Valley Light

SPERRY-GYROSCOPE

TELEGRAPH WESTERN UNION AND CABLE

ROCHESTER GRS N.Y.

Robbins & Myers

Weston

Electrical Indicating Instruments

are unqualifiedly superior to any other instruments designed for the same service.

A. C. or D. C., Switchboard or Portable Instruments for every field of Indicating Electrical Measurement. In writing for catalogs and bulletins please specify the field that interests you.

WESTON ELECTRICAL INSTRUMENT CO., 13 Weston Ave., Newark, N. J.

23 Branch Offices in the Larger Cities

Vol. 72, No. 3 New York, July 20, 1918 *Pages 97–144*

Electrical World

F. M. FEIKER, *Editorial Director* W. H. ONKEN, JR., *Editor*

Member Audit Bureau of Circulations, Member Associated Business Papers, Inc.

Contents

Editorials 97

Electric Power Supply for War Industries 100
By R. J. McClelland.
Shortage of Power a Major War Problem—Critical Railroad Situation Calls for Generation of Energy Near Mines and Transmission Electrically—Interconnection of Central-Station Systems in War Industries Districts Will Greatly Increase Capacity.

New England Coal Outlook Still Acute 105

Application of Relays to Industrial Control 106
By C. E. Clewell.
Among the Types Considered Are Acceleration Relays, Those for Reducing Motor Speed Under Excessive Load, and Relays of the Fluttering, Phase Failure or Reversal and Transfer Types.

Niagara Falls Power in the Great War 109
Plan to Distribute Hydroelectric Energy Produced on American Side or Imported from Canada to War Industries in Order of Importance Receives Approval of War Department—What Is Being Done to Meet the Emergency.

Increasing the Cost of Line Construction 111
By A. G. Hurd.
Poles, Wire and Labor Advance 10 to 90 Per Cent in Four Years—Good Management Has Kept Construction Costs from Rising So Fast.

War Problems Discussed by A. S. M. E. 112

"Hottest Spot" Temperature in Transformers 113
By Alfred Still.
Formula Developed for Calculating Maximum Temperature—Correction for Space Factor and Conduction Through Conductors Included—Application of Formula to Specific Case Illustrated.

Station and Operating Practice 115

Central Station Service 117

Technical Theory and Practice 119

Scientific and Industrial Research 121

News of the Industry 122

Recent Court Decisions 129

Associations and Societies 129

Current News Notes 130

Commission Rulings 130

Men of the Industry 131

Trade and Market Conditions 132

Current Prices of Electrical Supplies 136

New Apparatus and Appliances 138

Trade Notes 140

Trade Publications 140

New Incorporations 140

Construction News 141

Record of Electrical Patents 144

Advertising Indexes—Alphabetical, 113; Classified, 109-111; Searchlight Section, 38-61

JAMES H. McGRAW, *President* ARTHUR J. BALDWIN, *Vice-President* E. J. MEHREN, *Vice-President* EDWARD CALDWELL, *Treasurer* JAMES H. McGRAW, JR., *Secretary*

McGRAW-HILL COMPANY, Inc., 10th Avenue at 36th St., NEW YORK

CABLE ADDRESS, "Machinist"

WASHINGTON, 1410 H St., N. W.
CHICAGO, 1570 Old Colony Building
CLEVELAND, Leader-News Building
PHILADELPHIA, Real Estate Trust Building
SALT LAKE CITY, 1101 Newhouse Building
SAN FRANCISCO, Rialto Building
LONDON, 10 Norfolk St., Strand

Copyright, 1918, McGraw-Hill Company, Inc. Published Weekly. Entered as second-class matter, Jan. 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Publishers also of
Electrical Merchandising
Power
Electric Railway Journal
American Machinist
Engineering News-Record
Chemical and Metallurgical Engineering
Engineering and Mining Journal
Coal Age

United States, Mexico, Cuba, Porto Rico, Hawaii or the Philippines, $3 per year; Canada, $4.50; elsewhere, $6. Single copy, 15c.

No back volumes for more than one year and no back copies for more than three months.

Change of Address—When change of address is ordered the new and the old address must be given. Notice must be received at least ten days before the change takes place.

Circulation of this issue 21,000 copies

ELECTRICAL WORLD—*Member Society for Electrical Development, Inc.*—"DO IT ELECTRICALLY"

Trade-**FARADOID**-Mark

Porcelain Insulators

Patented

No. 2-33

The design of these insulators is based on the following scientific principles:

If the common surface of two dielectrics conform to the direction of the Faraday tubes between their electrodes, and if the electrodes are properly formed, the highest insulation efficiency is obtained.

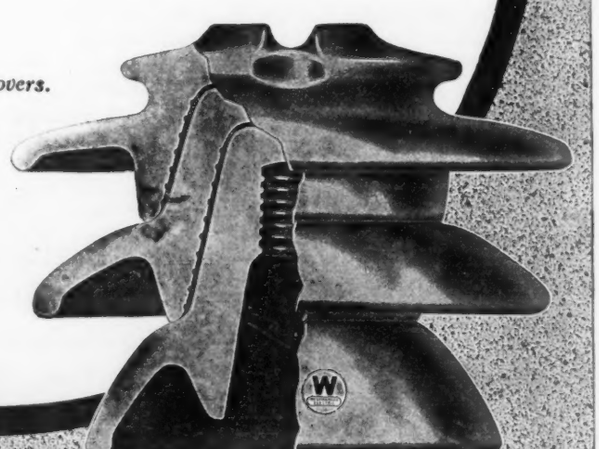
They are furnished in five sizes:

No. 2-22 for 22,000 Volt Service
No. 2-33 for 33,000 Volt Service
No. 3-44 for 44,000 Volt Service
No. 3-55 for 55,000 Volt Service
No. 3-66 for 66,000 Volt Service

See catalogue 6-A for dimensions and flashovers.

Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.

Sales Offices in All Large American Cities



No. 3-44

W WESTINGHOUSE ELECTRIC

Westinghouse

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 72 New York, Saturday, July 20, 1918 *Number* 3

The Niagara Water-Power Farce

LONG before the United States entered the war at all there was a serious shortage of power at Niagara Falls. The situation that exists therefore at the frontier is not unfamiliar to the operators there, except that the disease, having been allowed to run unchecked for a number of years, has become aggravated. With abundant water plunging over the precipice and with a site unparalleled for rapid and cheap development, the authorities have not turned a hand to remedy conditions. Instead, we have the ludicrous spectacle of power generated in distant steam stations being transmitted to Niagara Falls from time to time to alleviate the shortage. Was there ever a better example of incompetent handling of a serious problem? Canada and the United States agree that there should be greater diversion of the water at Niagara Falls. The power shortage on both sides of the stream has been acute for some time, the Province of Ontario requiring at least 100,000 hp. more and the State of New York 200,000 hp. Had both governments acted to revise the Root-Bryce treaty of 1909 when the need of such revision became apparent, there would now be ample power for war industries in both countries and there would be no necessity for burning precious coal to relieve the shortage. Is it not about time that our foreign affairs committee ended this farce?

Speed the Organization of the Contractors and Dealers

MEMBERS of the National Association of Electrical Contractors and Dealers, who reviewed in annual convention at Cleveland this week the first year under their new form of organization, can feel that they have done much to merit congratulation. What they have accomplished in the country-wide, intensive organization which is their ideal should be weighed with recognition of the adverse circumstances brought by the war. When this factor is given its full heavy weight and the counterbalance of new organization is credited, the net result is encouraging. Other associations in many lines of industry are simply marking time while the war lasts, but the contractors and dealers have managed not only to hold their own but also to move forward in the direction of the greater goal which now inspires them.

Fortunately for the contractors and dealers they had a national organization to serve as foundation for the greater structure which they are rearing. They had also a group of devoted loyal workers who are enthusiastically determined to build up, not tear down. What they lacked, if they lacked anything, was intensive organization to supplement national organization. They need to reach every city where there are contractors and dealers, every town where they can give help. Showing that they render real service to their members, they then have an unanswerable argument for new membership campaigns. The more nearly they approach to 100 per cent enrollment, the better able will they be to make the geographic local associations effective in carrying out the national program. But to get the number of members that are potentially available in this branch of the tremendous electrical industry will take time. It is more important to get a single new member than to talk about getting a thousand new members.

Although many men are timidly reluctant to embark in new enterprises when they think that the outlook is uncertain, it is in fact in just such times that the contractor-dealers' organization can be made of the greatest value to its members. For either war or the end of war carries problems which touch the small contractor-dealer who ought to be a large beneficiary in the new organization. War has been followed by construction which has crowded aside the construction of normal times. With the return of the normal conditions after the war there will be a world-wide demand for construction to meet the needs of peace. With this activity will arise questions affecting materials, questions touching labor, problems which every contractor and dealer will have to answer with the best judgment he has. Or, if the scarcely thinkable alternative of a world economically prostrate be faced for a moment, the contractor-dealer will benefit from organization. What he learns from contact with men in his industry will help him in any event to do his work better for the public.

Research and Prosperity

ONE of the vexed problems which confront the managers of manufacturing and operating companies is to determine the proper amount of time and money that it is profitable to spend at a given time on experimentation, new developments and research. When serious trouble develops in the operation of some electrical device it is usually easy to obtain funds to ascertain and to remedy the fault, but not so with problems of more remote or general character. When times are good and there are plenty of orders ahead

the scientific engineer is told that there is no need for research and that he had better don his overalls and help production. When business is slack and a prolonged depression threatens the country the scientific engineer is told that the problem is not to develop new devices but to keep the factory busy on the present types of apparatus. Invention and research cannot, however, proceed sporadically, and the responsible investigators must have at least some assurance of steady jobs and of sufficient funds for experimental apparatus. This fact must not be lost sight of.

One remedy, or at least a stabilizing factor, is the formation of trade associations for research purposes, each member of the association to be assessed a certain tax so that the research workers can look forward with a reasonable degree of confidence year after year. At a meeting on industrial research held during the last convention of the American Society for Testing Materials in Atlantic City the work of some such trade associations was reported. Another remedy lies in the growing interest which our federal government and the state governments take in pure and applied research. It is sufficient to mention here the pending possibility of making the National Research Council a permanent institution and also the splendid work in electrical and other branches of engineering and physics constantly turned out by the Bureau of Standards. But with all these outside helps our large manufacturing and operating companies must take a broader view of their own research work and keep it going "rain or shine."

Steps Toward Coal Saving

THERE is good reason to hope that the campaign for coal saving in industrial plants inaugurated by the Fuel Administration will meet with a substantial measure of success. Whether the savings attainable without radical change in equipment will reach the expected 20,000,000 tons is another matter, depending somewhat on how one would define "radical" changes. Probably the biggest single case of fuel waste in industrial plants and everywhere else is bad firing, especially in the smaller hand-fired plants. How far this condition can be remedied in the present labor situation is extremely uncertain. Whether really skillful firemen are attainable at all in the case of the smaller plants is an open question, for a first-class hand is in great request.

If all the plants concerned could be equipped with mechanical stokers, the average results would certainly be improved, although the highest figures would probably not be raised. Beyond the fire box come the questions of steam pressure, superheat and condensation. In the first two of these matters American practice has until very recently been ultra-conservative. Boiler pressures cannot be materially increased without change of boilers, as any given installation is commonly worked somewhere near its conservative limit, albeit this is generally set too low. Boilers cannot be changed without considerable expense and, what is just now equally important, considerable time, and the same is true of superheaters and condensers. Care in making the best of installations as they stand with small additions is probably the most practicable course for immediate improvement. Sharp looking after details such as proper jacketing of steam pipes, careful setting of engine valves, overhauling condenser pumps and keeping boilers free of scale and condensers clean are items which taken together may result in saving a really large amount of fuel. Inspection of plants and pressure brought on their owners to carry through practical recommendations for saving will certainly be extremely helpful. So far the program can be carried out in time to be effective in the coming season's operations. Meanwhile a general overhauling to improve conditions of economy in the larger way should be started at once in view of the difficulties of manufacturing and delivering necessary added equipment.

Interconnected Super-Stations at Coal Mines

SUGGESTIONS for relieving transportation difficulties and alleviating coal shortage are many and varied. Some have been good and others have been impracticable. Certainly, we cannot have too many minds working on these problems which are pressing for solution. R. J. McClelland has a cure to urge for the present coal and power shortage in the East. It is not a panacea, but it is probably the best and most potent, and at the same time the most readily available, corrective. His arguments, and particularly his conclusions, will bear close reading. In the main his proposition is to locate super-stations at the coal mines, develop available water powers and interconnect these systems into one great network from which existing distribution lines may receive a supplemental supply of electricity.

Plans of this kind, although on a less extensive scale, have been proposed before, because the idea of locating power stations at the mouth of coal mines has always been attractive. The trouble with most of the suggestions heretofore made has been that their proponents have been unduly solicitous about coal and have ignored the question of water supply entirely, little dreaming that it requires an enormous quantity of water for steam and condensing purposes and that as a rule abundant and suitable water is not available at coal mines. There are no such drawbacks in Mr. McClelland's scheme, which is a straight-out engineering proposition based on surveys and acquaintance with conditions.

Of course, there will be those who will object to the proffered solution. It is so easy for us to pursue the even tenor of our way and to add addition to addition rather than to attack the whole problem from an entirely different angle. There is, however, such a thing as making concentration too dominant and too expensive. It requires no argument to convince any one that our coal supply is diminishing. That is a fact. Nor will it be denied that coal must be brought from greater and greater distances. Now it is one thing to bring a few tons of coal from a distance to a consumer, but when the amount required reaches hundreds of thousands of tons the question assumes a different aspect. It then becomes necessary to decide, for purely economical reasons, whether it is better to move the coal or to move the plant. Some of these points are covered by Mr. McClelland in his article.

We have nothing but admiration for the enterprise

shown by the author in making the study under consideration and for his boundless faith in the future of the electrical industry. That the electrical industry is destined to go ahead there can be no doubt, and we are face to face with conditions touched on by the author. If now we can get action with the co-operation of the central-station industry, the task of supplying the increasing loads will already be half solved. One feature of the present situation which is hard to understand is the apathy of some central-station executives toward the progressive movement now under way. The war has shown great opportunities for the expansion of the electrical industry and has indeed pushed it far ahead of its time, and yet there are those who, instead of taking advantage of that help to expedite the movement, actually turn to remonstrate with the power that is urging them on. This inertia is hard to overcome, but the industry must go forward despite that handicap. Studies like that of Mr. McClelland help blaze the way.

The Curtailment of Lighting

THE ELECTRICAL WORLD believes in backing the administration to the limit in the effort to bring the war to a successful conclusion. It does not, however, believe it to be a patriotic duty to indorse all the sometimes hysterical and silly suggestions of administration subordinates. Reports are abroad of an impending effort greatly to reduce the consumption of both gas and electricity for domestic purposes, thus throwing the weight of efforts at so-called conservation upon the ultimate public. We trust that such reports may be classified with pro-German propaganda, like the rumors that were carefully circulated regarding the government's intention to raid the householder and commandeer his preserves; but if there is an intention on the part of any one to put the screws on the supply of electricity for domestic uses we wish here and now to file a protest of the most emphatic character, based on the entirely trivial saving which could be thus made compared with the inconvenience put upon the people and the waste of energy still permitted to go on in the prosecution of unnecessary business.

The whole subject of lighting curtailment was gone into early this year, and it was shown in Preston S. Millar's admirable paper and the discussion which followed that all the coal used for domestic lighting amounted to just about one-half of 1 per cent of the country's total coal consumption. This minute amount could, of course, be cut down by rigorous regulation to the possible saving of 0.1 or 0.2 per cent, at an entirely disproportionate amount of public inconvenience. The spontaneous efforts at economy in all things made necessary by the present costs of necessities is quite sufficient to reduce the use of light as far as is generally desirable, without any attempt at regulation. The daylight-saving campaign has already done its bit, and the harassed householder, without the compulsion of efforts at regulation, may be trusted not to waste light. If it is necessary to save energy for war industries, let it be saved at the expense of those unnecessary activities which not only make for waste of the public's money but for the needless employment of labor which might be better utilized in those things which bear directly on the prosecution of the war. One has only to look around in any direction to see industries which, so far as this great purpose is concerned, are simply economic wastes, using up important labor and material in order to create temptation to unnecessary expenditures. Many of these fruitless industries have already been pressed to reduce their coal consumption, but why they should not be suppressed entirely for the period of the war rather than allowed to burden the general public with their wastage it is somewhat difficult to see. Some of the purveyors of hysteria have professed great fear lest the labor which might thus be thrown free should come to some bad end, but any one who knows the labor situation, or even reads the papers and sees the frantic calls for labor which is not forthcoming, realizes the foolishness of this attitude. How about the million men who have gone to the front to fight our battles and the millions who will follow them? They have laid down their work without protest to do a soldier's duty. Is it too much to ask of those whom they have left behind that, for the public good, they should shift their activities from useless to useful occupations and bring the country promptly to that industrial efficiency which must inevitably come if our country is to do its part?

We are making no plea on behalf of the electric lighting companies, which are doing their duty cheerfully and uncomplainingly. They are turning their output to useful ends, and a little more or less domestic lighting is a matter of no great concern to them in the long run; but it is a matter of concern to the man on the street whether he is to be called upon to make sacrifices, not for the common weal, but for the continuation of unimportant business which might better be dispensed with. England has already gone through all the phases of this struggle between the substance and the non-essentials of industry, and by that experience we may well profit. To those who would guide the people in the path of genuine conservation we would commend daily and hourly consideration of the words of the late Lord Rhondda, British Food Controller, when he was about to take office: "I am going over there as the guardian and trustee of the consumer, and particularly the poor consumer." And Lord Rhondda lived up to that righteous resolution and died in harness.

The Coming Issues

A SYNOPSIS of what has appeared on iron-wire transmission, with some further information regarding the electrical and mechanical characteristics of both solid and stranded steel wire, will be presented shortly in the ELECTRICAL WORLD. Another timely article will show how a medium-size station in the Middle West is equipped to store coal for the coming winter. Difficulties encountered in constructing a hydroelectric plant on the Pacific Coast—such as space limitations and changes in plans after ordering equipment—will form the basis of still another discussion. The next installment of the industrial control series will deal with the selection and application of motors and control in the paper and pulp industry.

Electric Power Supply for War Industries

Shortage of Power a Major War Problem—Critical Railroad Situation Calls for Generation of Energy Near Mines and Transmission Electrically—Interconnection of Central-Station Systems in War Industries Districts Will Greatly Increase Capacity

BY R J. McCLELLAND

THE extent and the real significance of the enormous industrial expansion brought about by war industries are not at all appreciated by the public, even by the engineering public. The magnitude of the attendant problems, their endless ramifications and their vital influence upon our whole industrial system are just beginning to be realized even by those closely in touch with this great work.

The direct problems of production have received much public attention. Great as these are, however, they are in essential respects less difficult and less critical than the problems presented by congested transportation facilities and shortage in power supply. The railroad transportation situation is at last being recognized as the critical element in our industrial program. Inadequacy of railroad facilities in the Eastern industrial districts is forcing drastic changes in our plans, is going to cause serious disturbance to enterprises already under way and will inevitably occasion widespread public distress during the coming winter. Railroad systems are inelastic and incapable of rapid emergency expansion, and relief in this respect must be largely indirect.

The problem of power supply is intimately connected with the railroad situation, both because it is one of the principal contributaries to the existing and prospective transportation congestion and for the reason that to some extent it may be so handled as to afford considerable relief to this congestion. Power supply is just as essential to our war industries as labor or materials, but with the important difference, that to obtain labor and material for construction purposes, or even to build a shipyard or factory, is usually a question only of months, whereas the construction of large power systems is an undertaking of from one to two years.

In this country, as has been the case in England and France, the problem of power supply is virtually one of providing electrical energy. This war emergency has carried us many years forward in our industrial evolution and is forcing manufacturers, willingly or not, into an era of electrification. As our man power decreases—a considerable actual decrease is inevitable, and relatively to the size of our task a very great decrease is already upon us—the shortage in man power must be made up by the use of automatic machinery and various power-consuming appliances. There is scarcely any characteristic of these extended new enterprises so striking as the extent to which they use and depend upon electrical energy.

SERIOUS POWER SHORTAGE FOR WAR NEEDS

There exists now and will continue to exist a most serious shortage of electric power in all of the war industry districts. Our whole war program will depend largely upon how promptly and how effectively we make good this power shortage. In the industrial district comprised in eastern Pennsylvania, northern Delaware and New Jersey the largest, and probably for an indefinite period the most important, of the centers of new industrial activity, it is estimated that within the time required to develop additional power facilities on a large scale 500,000 kw. of additional capacity will be required for essential war needs. Referring to this district, William Potter, the Pennsylvania Fuel Administrator, in a letter to Dr. Garfield under date of May 13 makes the following statement:

There is a recognized power shortage in the section mentioned, where are located industries whose products are vital to successful prosecution of the war. Opinion is undivided that, unless immediate action is taken, it probably will develop into a national crisis that in its consequences may not differ from that which would arise were huge or-

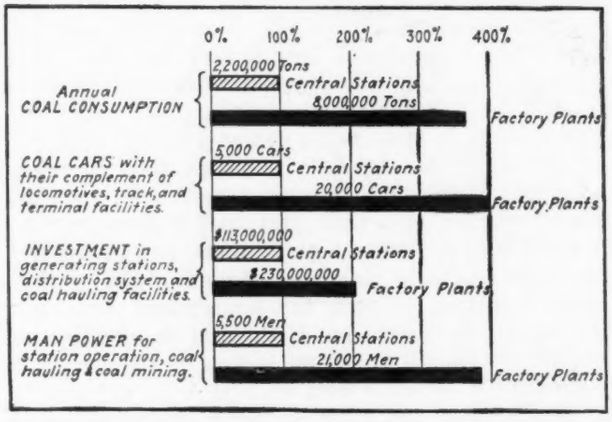


FIG. 1—COMPARISON OF CENTRAL STATIONS AND ISOLATED FACTORY PLANTS FOR SUPPLY OF 500,000 KW. OF WAR INDUSTRIES LOAD IN EASTERN PENNSYLVANIA, NEW JERSEY AND DELAWARE.

ders placed for airplanes without inclusion of the purchase of necessary motors. The power used for turning out a shell is as important as the metal required to make a shell or the wool required to make a uniform. . . .

There is grave danger that we will soon find ourselves in a situation similar to that of England two years after her entrance into the war and against which we have been forewarned by her engineers. Industries were constructed, other facilities of existing plants increased, but the power requirements were overlooked, because central stations were looked upon as something indefinitely elastic in nature. This oversight caused England nine to twelve months' delay in her war problem.

Similar shortages exist in New England, very acutely in the Pittsburgh district and the adjacent industrial regions in Ohio, and to a less serious extent in other sections of the country.

This increasingly great use of electric power is not something which will end with the war, so we should not allow any lingering apprehensions of future idle equipment to damp our energies in meeting the emergency demands which are upon us. In Great Britain plans far more comprehensive than anything even talked of here are being laid years ahead for increasing, inter-

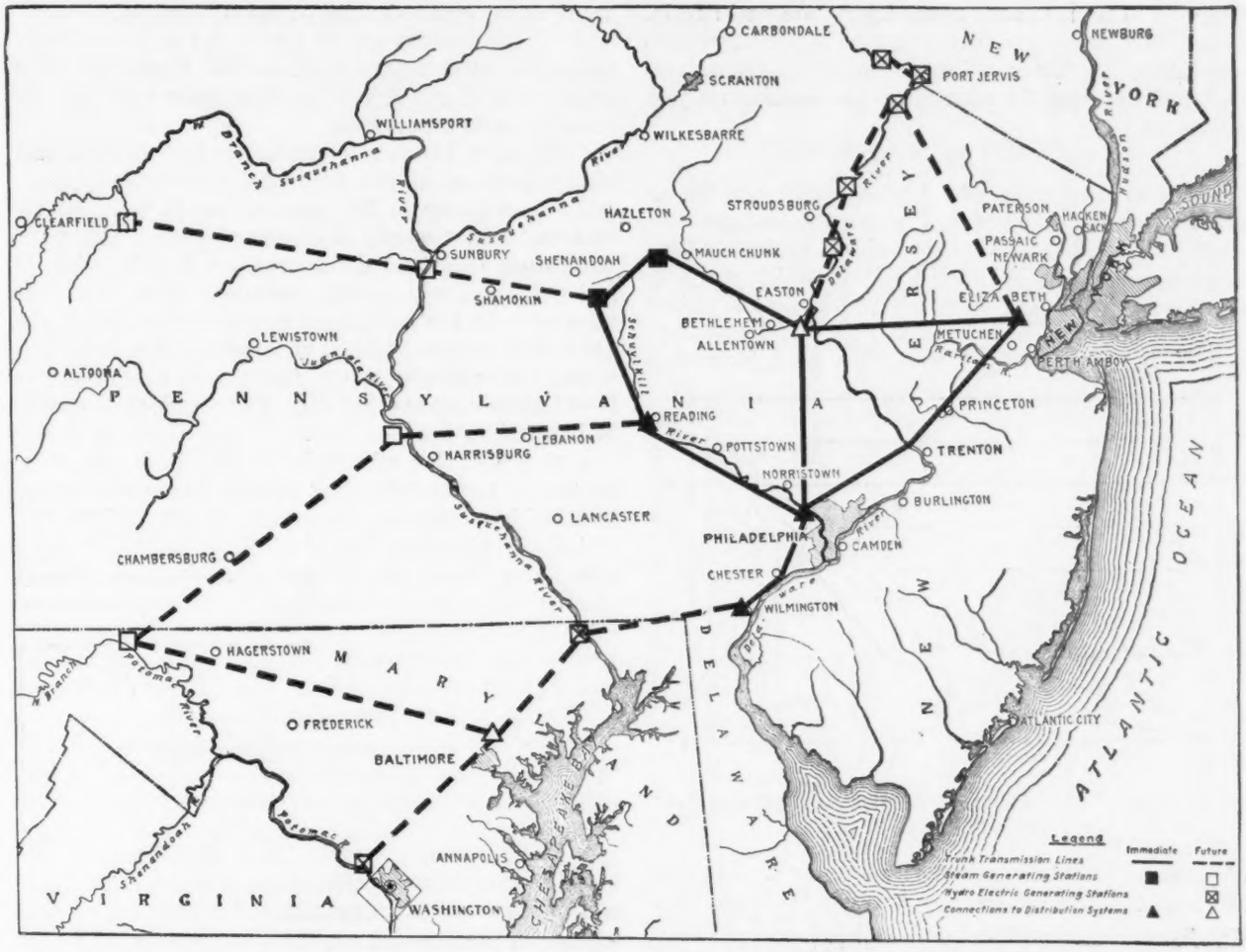


FIG. 2—SYSTEM OF HIGH-VOLTAGE TRUNK TRANSMISSION LINES CONNECTING LARGE EASTERN INDUSTRIAL CENTERS

connecting and centralizing the supply of electrical energy, for making it the very lifeblood of a greater industrial England. This country must keep its place in the industrial world after the war—must increase it if our promised 25,000,000-ton merchant marine is to be given cargoes. If we grant this, we are permanently face to face with this problem of power supply in all of its new-found importance. We must make our present emergency an opportunity, must keep mobilized our war-time spirit of comprehensive organization and efficiency. This is the time to formulate comprehensive plans for our future power supply. It is our good fortune that effective measures to meet immediate vital needs will fit in with such plans.

Isolated Plants on Large Scale Impracticable

The proposition of supplying these increases in power requirements principally from isolated power plants at each factory needs only to be set forth in terms of its demands upon our fuel resources, transportation and manufacturing facilities and man power for its unthinkable wastefulness, and in fact its physical impossibility, to be evident. (See Fig. 1.) Referring merely to one feature of the comparison, isolated plants would require about four times as much coal as central stations, which means four times as many coal cars with their complement of locomotives and track and terminal facilities. With our railroads already insufficient for the emergency demands and facing even more serious inadequacy as our war industries enter the stage of full production, such a demand upon them would be impracticable, even aside from its being needless.

Local Central Stations Not Real Solution

Central stations situated near the load centers do not, however, constitute the final solution of the power problem, either for immediate emergency purposes or for a comprehensive plan of future power supply. For our future needs we must depend, in the East, partly upon development of our larger medium-head and low-head water powers, but principally upon huge super-steam plants burning low-grade fuels and erected in the vicinity of the mines. The fullest possible advantage should be taken of diversity and the other economies which may be gained from interconnection of electrical systems. Plans of broad scope under governmental supervision are being laid along these lines, and indeed are already under way, with our hard-pressed allies in Europe—interconnected water-power developments in France and huge interconnected mine steam plants in England. Our present emergency needs we can meet adequately only by taking the first steps toward such an ultimate system. Steam-electric plants in the mining regions are fortunately within range of emergency needs as to time of construction, and transportation congestion furnishes an unanswerable argument in their favor.

The two fundamental considerations governing our

policy as to future power requirements are fuel supply, present and future, and transportation facilities, present and future. A few facts bearing upon these considerations will indicate the reasons for the conclusions just expressed.

COAL SUPPLY OF UNITED STATES

The coal reserves of the United States are widely regarded as so enormous that no present thought need be given to their possible exhaustion. Enormous they unquestionably are, but at the rate at which coal consumption is increasing their life will become a matter of concern within another generation. Coal consumption during the last three years has been increasing

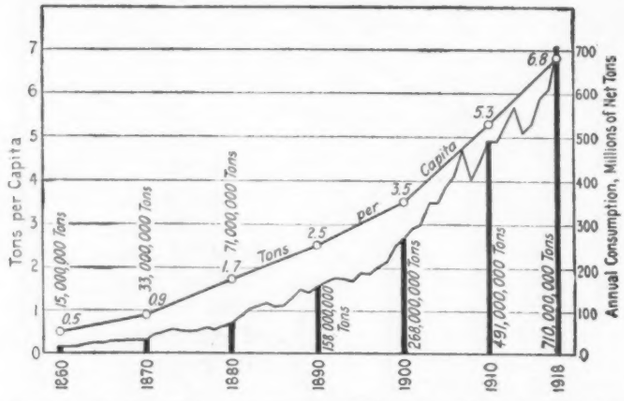


FIG. 3—CHART SHOWING THE INCREASING CONSUMPTION OF COAL IN THE UNITED STATES

at a rate of over 10 per cent per annum. For the past twenty years the increase amounts to 6½ per cent annually. The necessary production for 1918, as estimated by the Fuel Administration, is 710,000,000 tons*, an increase over 1917 of 14.4 per cent. A conservative estimate of our present normal rate of increase is 7 per cent. On this basis, and with a rate of recovery from the mines as high as 67 per cent, the life of our known coal reserves would be as follows:

	Years
Eastern District, which includes the most accessible and best quality of our fuel	56
Eastern, Central and Southern Districts	64
Entire United States and Alaska, over two-thirds of this being low-grade coals and lignites	83

(These figures are based upon estimates of the United States Geological Survey. They include coal in veins as shallow as 14 in. (35.5 cm.), all coal up to 30 per cent ash and all known deposits within 6000 ft. (1828 m.) of the surface. Obviously, on a corresponding basis the life of the coal reserves minable and usable under present standards would be much shorter. The reserves of fuel oil and natural gas are relatively so insignificant that they would have no appreciable effect on these figures.)

These figures are startling. They do not mean, of course, that our Eastern coal will be exhausted in fifty-six years or our entire fuel supply in eighty-three years. What they do mean is that the time is in sight when we must cut down our rate of increase in coal consumption. They mean also that coal is going to be increasingly expensive.

The figures are even more impressive when we consider that the United States has about 52 per cent of the coal reserves of the entire world, and North America about 69 per cent. Outside of North America, the only really large deposits are in China and are not readily accessible. The next largest are in Germany. This means that in the future we must more and more be called upon to export coal.

Curtailment in our rate of increase in fuel use means either checking of our industrial development or increasing economy in the consumption of our fuel resources. Power supply is going to be the backbone of our future industrial development, and it is going to make increasingly great demands upon our fuel reserves. At the same time power use of coal is the use which is most wasteful of its chemical and thermal value. Accordingly every feasible fuel economy in power generation is called for. The principal economies to be attained are:

1. Centralization of supply of industrial and other power in large generating plants, embodying every practicable measure of efficiency. Large modern central stations have a thermal efficiency of 20 per cent, about four times that of a reasonably good isolated plant.

2. Fullest possible utilization of water powers within economic limits as to cost. The majority of our Eastern water powers can be utilized most effectively only as auxiliaries to large steam-electric systems.

3. Electrification of steam railroads. Steam railroads at present consume more than 25 per cent of our coal output. By electrification this could be reduced to 7 or 8 per cent.

4. Electrification of coal-mining operations, particularly in case of anthracite mines, where a mine usage of 10 per cent could be reduced to 1.5 per cent by electrification, representing a saving, at the present rate of production, of nearly 10,000,000 tons annually.

Although conservation of fuel resources is not *per se* of immediate interest in our war emergency, the question of man power involved in coal mining is an increasingly important war problem. Of the most urgent and vital importance, however, is the question of transportation facilities for fuel.

TRANSPORTATION OF COAL A CRITICAL PROBLEM

Any plan which will reduce the amount of coal which the railroads must haul will be of first importance as a war measure. Fuel transportation, owing to its magnitude and to the utter inadequacy of our supply of coal cars, is the most critical feature of the transportation problem.

In the Central Atlantic seaboard district, where transportation congestion is most serious, material relief may be effected by drawing a portion of the new power requirements from large steam stations situated in the anthracite mining region and transmitting the power over high-voltage lines. No delay in our program would be involved, since new steam stations near the mines and the necessary transmission system could be constructed as rapidly as new steam stations of equal capacity in the seaboard district.

In our immediate emergency transmission systems can readily be built, while adequate increase in transportation facilities is impossible. In spite of every possible effort to increase the capacity of our transportation systems and to add new rolling stock, railroad facilities will for a long time in the future be seriously inad-

*This figure, as are all other tonnage figures in this article, is based upon net tons of 2000 lb.

equate. On the other hand the manufacturing facilities which will be called upon to supply transmission material and equipment are not seriously overloaded and are not engaged to any considerable extent upon war work.

INCREASING POWER CAPACITY BY INTERCONNECTION OF SYSTEMS

The necessary increases in electrical generating capacity present a difficult problem. Facilities for manufacturing large generating units are limited, seriously limited, in spite of all the efforts which the government has made to increase production and to limit new installations not contributing to the war program. It is essential that the greatest possible output be had from present installations and from the inadequate amount of new equipment which will be available.

The effective capacity of our generating stations can be increased promptly and very materially by taking now the first step in our inevitable ultimate system, high-voltage interconnection of our larger systems. The advantages, it may even be said the necessary reasons, for such interconnection are numerous:

1. Interconnection would materially increase the load which may be carried on the otherwise separate generating systems as a result of the diversity in peaks. The subject of diversity has been studied considerably of late for several situations, and it appears that even between systems of similar load characteristics a large diversity exists, since even though the peaks of the separate systems may occur at about the same time in the day, the individual maximum peaks do not occur on the same day.

2. Interconnection will make possible the use in regular service of a large portion of the generating capacity otherwise required for reserve, since the transmission lines will make reserve capacity at any one point available for use over the whole interconnected system. It appears a safe estimate that, owing to release of reserve equipment and to diversity, the capacity of a group of large systems would be increased by from 15 per cent to 25 per cent as a result of interconnection. As an instance, studies were recently made of the small systems north and south of Boston (see ELECTRICAL WORLD, June 8) indicating an increase in capacity of 37 per cent as a result of interconnection.

3. Interconnection should result in considerable fuel economy, since it will enable the largest, most efficient and best-located plants to operate at maximum load factors, the less efficient plants being used only when needed.

4. Transmission interconnection will afford the means of utilizing to maximum advantage energy from steam plants in the mining districts as soon as these can be built.

5. Such a transmission system will afford the nucleus of a comprehensive power supply system. It will greatly advance a rational national fuel conservation program and in particular will constitute an important step in the electrification of our Eastern trunk railroads.

Interconnection of large systems is by no means a new expedient, and the advantages to be gained have been thoroughly demonstrated in practice. The great benefits realized in California have received wide publicity. Similar interconnections are now being made in Oregon and Washington and have already been effected in Texas, Illinois and in New England, as well as to a lesser extent in other places. In the South 780,000 kw. in generating stations in four states is interconnected, and another system of 175,000 kw. in another state will probably soon be tied in. In this huge system all available water power at any point is fully utilized before steam is called upon, and the water power itself is operated at an efficiency wholly impossible before the interconnection was effected. For instance, seasonal surplus water power at one plant in North Carolina is now used to fill the storage reservoir of a plant in Georgia 500 miles (804 km.) away by transmission-line distance.

POSSIBILITIES OF INTERCONNECTION IN CENTRAL ATLANTIC SEABOARD

As has been noted, the estimated immediate requirements in eastern Pennsylvania, northern Delaware and New Jersey are about 500,000 kw., which added to the existing loads on the larger central-station systems in this region will make a total load of 1,000,000 kw. A study of the loads in the three largest systems of the district indicates that the present diversity is in excess of 12 per cent, and with other systems included in the interconnected system presumably the diversity would be greater. Accordingly 10 per cent at least may be taken as an eminently conservative estimate for the diversity in the total load of 1,000,000 kw. This would mean that 100,000 kw. in installed generating capacity could be saved through the diversity made available by interconnection.

At the same time, the reduction which would be effected in emergency reserve requirements would probably amount to 75,000 kw., since a minimum of 15 per cent reserve is needed on the present system—ordinary

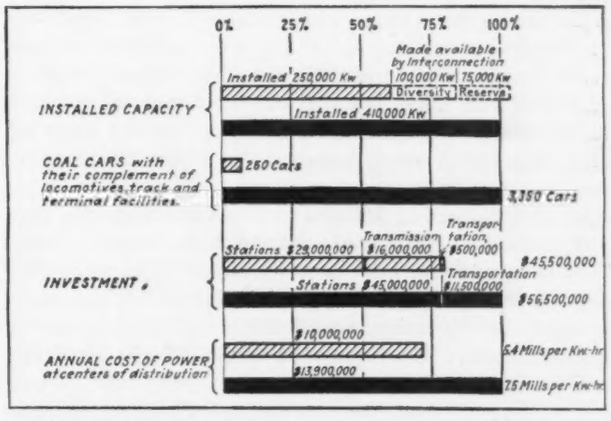


FIG. 4.—COMPARISON OF NEW LOCAL CENTRAL STATIONS VERSUS INTERCONNECTION AND GENERATION NEAR MINES FOR SUPPLY OF WAR INDUSTRIES LOAD

practice provides considerably more—and at least half of this could be saved by interconnection.

Interconnection of these systems with loads aggregating 1,000,000 kw. would thus result in an effective increase in generating capacity of 175,000 kw., corresponding to a saving in investment of about $20,000,000, which is considerably more than the cost of the necessary transmission system, including step-up stations and step-down substations.

Similar savings would result from interconnection in the Pittsburgh district and in New England. In New England a portion of this advantage has already been realized.

The policy of supplying a large portion of our power requirements from generating stations in the mining regions is not merely a temporary war-time necessity. It is a measure of permanent general economy and will form an important feature of any broad plan for future power supply. There are a number of advantages in locating electric generating capacity in the mining regions, but the fundamental consideration is that, on a sufficiently large scale, it is cheaper to transmit electric power over wires than to haul over railroads the amount of coal required for generation of an equal amount of energy in the district where it is consumed. The investment in the transmission system is not materially greater than the investment in a corresponding amount of railroad facilities, while the railroad operating expense, constituting the greater part of railroad costs, is nearly a clear saving, since the operating expense of the transmission system is relatively negligible.

Mine generation has the further important advantage of utilizing effectively the lowest grades of fuel. This is particularly important in the case of generation in the anthracite district, which saves high-grade bituminous and semi-bituminous coal (our most valuable fuel) by using the smallest sizes and poorest quality of anthracite, most of which is uneconomical to transport and has only a limited field of usefulness.

A number of satisfactory generating station sites are available in or near the anthracite district, and the reliability of modern transmission with duplicate lines is wholly comparable with that of modern central stations. In the immediate emergency it probably would not be advisable to supply all of the 500,000-kw. requirements for the region in question from stations in the anthracite district, since in the first place time can be saved in the installation of a portion of a needed capacity by making extensions to local central stations now in service or under construction, and in the second place an immediate mine installation for the total amount might create a requirement for the smaller sizes of anthracite which would unduly disturb existing arrangements.

An installation of 250,000 kw. in the anthracite district, which is practicable immediately, would supply 235,000 kw. to the load centers, about 100 miles (160 km.) distant. This 235,000 kw., with 100,000 kw. made available by diversity, would leave 165,000 kw. to be installed locally. To supply the whole 500,000 kw. from local central stations would have required, with 15 per cent reserve, the installation of 575,000 kw., so that the 250,000-kw. mine installation with the interconnecting transmission system would correspond to 410,000 kw. of local central-station capacity.

The electrical transmission of the output of the proposed 250,000-kw. mine installation, operated at a high load factor, would save the railroad transportation of over 1,300,000 tons of bituminous coal with an average haul of over 300 miles, releasing for other uses more than 3000 coal cars with their complement of locomotives, track and terminal facilities. It might be pointed out that this represents a saving in railroad operating expense of possibly $2,000,000 annually and in permanent investment in railroad facilities of about $11,000,000 at present price levels. The economic effect cannot, however, adequately be expressed in dollars. The true value of this saving lies in the release of these invaluable transportation facilities for other immediate and vital needs. It means greater output of war materials and more coal for domestic needs. It is measured in terms of the lives of our soldiers and the health of those at home.

Since this same transmission system would serve both to deliver power from mine stations and to interconnect central-station systems, it would fulfill two functions, either one of which independently would be more than sufficient to warrant the required investment or the demand which its installation would place upon our manufacturing resources and our man power.

The plan proposed is fundamentally one of high economy, wholly aside from its emergency advantages. In the following brief comparative analysis, costs are assumed at the present levels. A lower price level would increase the margin of advantage.

COMPARATIVE INVESTMENT AND ENERGY COSTS OF LOCAL CENTRAL STATIONS AND OF AN INTERCONNECTED SYSTEM FED FROM STATIONS NEAR MINES

	—Alternative Plans Giving Equal Capacity— 250,000 Kw. at Mines and Interconnection	410,000 Kw. in Local Central Stations
Investment:		
Generating stations	$29,000,000	$45,000,000
Transmission system, including step-up and step-down substations	16,000,000	.....
Total	$45,000,000	$45,000,000
Total including railroad facilities	45,500,000	56,500,000
Annual Costs:		
Fixed Charges:		
Stations	$3,500,000	$5,900,000
Transmission	1,700,000	.....
Fuel:		
At mines, 2,070,000 net tons at $1.75	3,600,000	.....
At seaboard, 1,300,000 net tons at $5	.....	6,500,000
Operation and maintenance		
stations	1,000,000	1,500,000
Transmission	200,000	.....
Total	$10,000,000	$13,900,000
Per kilowatt-hour	5.4 mills	7.5 mills
Increase per kilowatt-hour	.....	39 per cent.

CONCLUSIONS

The fundamental consideration governing power supply for war industries in the East is the railroad situation. Our whole war industries program depends very largely upon how this problem of power supply is handled in its relations with the railroad situation. The supplying of more power for our major war industries is no longer, has really never been, a choice between power generation at points of use with transported coal versus power generation at mines and the economies of transmission interconnection. The alternatives are supplying these industries over transmission lines and shifting the industries to other parts of the country. As evidence of this, the following is the essential part of an important joint announcement made public a few weeks ago by the War Industries Board and the Fuel and Railroad Administrations:

A policy has been adopted and made effective for preventing further increase in the volume of war orders and the number of establishments handling them in the area known as the congested manufacturing and transportation district. . . .

Careful analysis of the possible coal movement shows that the increased industrial activity in the Eastern States has created a requirement for coal which exceeds the limit of possible transportation of coal plus necessary materials for manufacture.

Consider what this means in industrial efficiency. The

logical location for most war industries is near the ports from which the products will be shipped, since the finished products require greater transportation capacity than raw materials, and since this location obviates reverse direction hauling of raw materials or partly finished products. Referring to the alternative of mine power versus shifting of industries, the Pennsylvania Fuel Administrator in the letter referred to above makes the following statement:

There is a well-defined report of production embargoes against certain sections of the country as well as removing of industries to the Middle West. There is no doubt that the power division of the Council of National Defense is prepared to show that the cost in time and money of removing industries or building new industries in other centers cannot be compared to the cost of developing necessary power either as a financial proposition or as a physical task. There is no doubt it can be shown that the project to move industries will simply delay the day of reckoning.

A comprehensive and rational policy for future power supply for maintaining our industrial standing after the war and the vital need for effective conduct of our war program, both call for prompt and large expansion of our central-station systems, wide interconnection and substitution of electrical transmission of energy for railroad hauling of coal.

This advance in the art has not been taken up heretofore, because to be effective and economical it must be done on a grand scale, on a scale more comprehensive than our business executives have been accustomed, perhaps have been able, to think and act.

It requires whole-hearted co-operation between the various central-station systems involved. Under present conditions at least it requires government supervision and government assistance. It is beyond the scope of any private enterprise at this time, and the proposition is essentially a national one. The opportunity and necessity for doing things on a grand scale are upon us. This problem of power supply is a thing so big and important, not only for our war program but for the future economic life of the country, that no petty obstacles of inertia or personal prejudice or corporate caution should be permitted to stand in its way. It is believed that full co-operation of private interests will be forthcoming, and the support of the Fuel Administration, the War Industries Board and the Council of National Defense is assured. Preliminary plans were drawn up months ago. The situation awaits appropriations by Congress and action by the administration.

It is a truism which has been frequently stated that war requires the mobilization of the nation's industries and their devotion to essential work. This is especially true in this country. To operate these industries, it has been necessary to mobilize to the fullest extent our available material and labor, but material and labor can only be converted into war work by the application of power. This power, in view of its great economy and flexibility, must be electrical.—*E. W. Rice, Jr., before American Institute of Electrical Engineers.*

THE NEW ENGLAND COAL OUTLOOK IS STILL ACUTE

"Conservation Is the Best and Surest Coal Mine We Have," Declares the Fuel Administrator

Fuel Administrator James J. Storrow of New England returned to Boston a few days ago after a conference with the Washington authorities relative to improving rail shipments of steam coal into the Northeast. Mr. Storrow said that after a re-examination of the New England fuel situation and the war activities of that section, and with a full knowledge of the war needs of other parts of the country, it was decided for the second time that New England must have 30,000,000 tons of steam coal during the twelve months which began April 1. The national Fuel Administration has now issued a series of orders to the various coal-mining regions to get back to this program and maintain the shipments, which are at present about 1,500,000 tons behind. It is expected that the additional coal will begin to arrive in the near future. In May 190,000 tons was gained in shipments of coal by water into the New England States.

Mr. Storrow said that, as nearly as he can estimate, fully 75 per cent of the factories of New England are carrying on war work, and that an adequate supply of coal is essential to the war program laid out by the government.

"Many manufacturers have already begun conservation with a will," said Mr. Storrow in a recent interview, "but some are still lagging. Conservation is the best and surest coal mine we have. We must work it to the limit. Every New England manufacturer, if he will get on the job, can save coal, and it is absolutely up to him to do it."

It is hoped to make a saving of at least 3,000,000 tons in New England fuel-burning plants during the present year. Formal pledges of co-operation have been made to Mr. Storrow by the organizations of engineers and firemen in Massachusetts. Coal dealers within the state have been forbidden to deliver domestic sizes of anthracite to manufacturers, or for use in hotels, business blocks or office buildings, without a special permit from the United State Fuel Administration at Washington. Anthracite screenings, it is understood, can still be used by power plants in connection with bituminous coal.

The larger central stations in New England are at present reasonably well provided with coal for immediate requirements, but the managements are looking forward to the coming fall with considerable anxiety, despite the priority orders which public utilities are entitled to receive.

A recent effort to arrange with the federal government for building vessels in the Boston district for the coal-carrying trade of New England has resulted in failure. The enemy submarine attacks on coastwise shipping sunk a small portion of the fuel supply then in transit to New England, and the shortage of bottoms due to war requirements is bound to be felt materially after the summer is over. Managers are endeavoring to put coal in storage as far as is feasible in anticipation of the peak loads that will confront them in the coming months.

Application of Relays to Industrial Control

Among the Types Considered Are Acceleration Relays, Those for Reducing Motor Speed Under Excessive Load, and Relays of the Fluttering, Phase Failure or Reversal and Transfer Types

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania

WHILE there are several methods of series-relay control for a motor during acceleration, the underlying principle is to use a relay with a series winding, having a contact disk which is held up and away from the contact fingers as long as the current through the relay coil is above the value for which the relay is set. When the current falls below this set value, the disk drops to the contact fingers, thus completing a circuit to the shunt coil of a magnetic contactor. The disk of the relay is held open mechanically until the current is established at the start.

ACTION OF THE SERIES-RELAY MOTOR STARTER

The action of the series relay as applied to an automatic motor starter can be explained best by a wiring diagram (Fig. 1). A push-button switch is shown at the upper right-hand corner of the diagram. When closed, to start the motor, this push-button allows the current to flow through the shunt coil of the right-hand contactor switch, closing this switch and completing the motor armature circuit through the starting resistance. The contact disk of the series relay is held up mechanically before the push-button is closed, and thereafter as long as the armature current flowing through the series coil of the relay is above a predetermined value. The solid line arrows in Fig. 1 indicate the path of the armature current after the right-hand contactor switch closes.

As the motor speeds up, the current through the armature, and hence through the series coil of the relay, tends to fall off to the value for which the relay is set, and at this point the contact disk of the relay falls and thus completes the circuit through the shunt coil

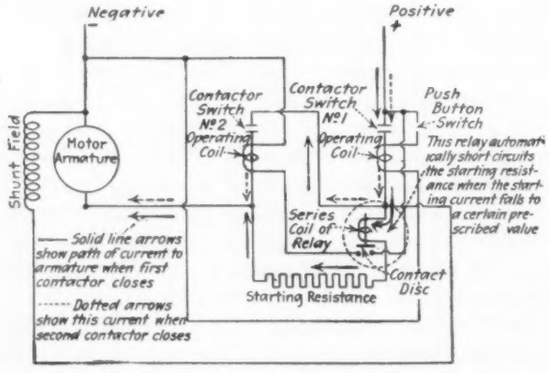

Negative
Positive
Shunt Field
Motor Armature
Contactor Switch No 2 Operating Coil
Contactor Switch No 1 Operating Coil
Push Button Switch
This relay automatically short circuits the starting resistance when the starting current falls to a certain prescribed value
Series Coil of Relay
Contact Disc
Starting Resistance
Solid line arrows show path of current to armature when first contactor closes
Dotted arrows show this current when second contactor closes

FIG. 1—ONE METHOD OF AUTOMATIC ACCELERATION USING SERIES RELAY

of the left-hand contactor switch, allowing the armature current to take the path shown by the dotted arrows, owing to the closing of the left contactor and the consequent short-circuiting of the starting resistance.

By the scheme outlined the starting resistance is cut out in a manner proportional to the load. It will be apparent that this action is not affected by variations of the line voltage, nor does it depend on the heating of the relay coil, as is the case in some other methods of starting. The fact that the relay will not close until the load current drops to the prescribed value means that it serves as a limit to the load which can be started by

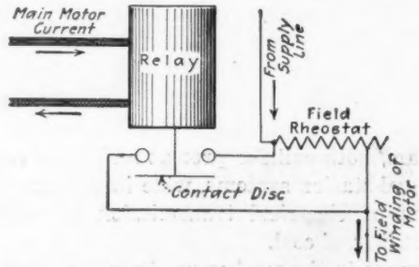


FIG. 2—RELAY FOR REDUCING MOTOR SPEED UNDER EXCESSIVE LOAD

the motor. These characteristics may all be advantageous in this method of automatic starting, but, on the other hand, such a device may result in too rapid acceleration at light loads if the relay is adjusted for a heavy load. The fact that the motor will not start on overloads may also be a disadvantage at times. It is obvious that the use of a relay adds equipment to the starter.

This series-relay method of starting is applicable to both direct-current and alternating-current motors. In designing series-relay starters it is the general practice to employ a relay for each magnetic contactor switch. The diagram of Fig. 1 shows merely one step of starting resistance, whereas for large motors several steps may be necessary.

PROTECTIVE RELAYS

Types of relays designed for protective purposes are named in the accompanying table,* with their uses and functions. The series overload relay is usually employed in conjunction with the under-voltage trip, but may be used singly or in other combinations. For voltages below 2500 and currents less than 200 amp. the elements are generally connected directly in circuit, but above these limits voltage and current transformers are usually employed.

The overload relay illustrated in Fig. 4 (a) is adaptable to use with the ordinary shunt switches of automatic starters in those cases where it is desired to open these switches automatically because of the flow of current in excess of any predetermined value for which the relay is adjusted. The series coil in Fig. 4 (a) is for tripping the relay, the shunt coil at the top being used so as to reset from a master controller.

Other types of overload relays which may be men-

*Abridged and slightly rearranged from a tabulation by S. Q. Hayes in "American Handbook for Electrical Engineers," p. 1216. Several references have been made to this handbook section in the preparation of this article.

tioned include a time-element device like that in Fig. 4 (b), which in this case is arranged for resetting by hand. Fig. 4 (c) shows a direct-current series relay for use with shunt switches to regulate the acceleration rate through current control. (See also Fig. 1.) The ability of all motors to stand large currents for a short interval without injury to the motor or controller makes the time element of industrial motor overload protection devices of all kinds an important item.

The advantage of the overload relay in comparison with the fuse is due to the convenience of restoring a relay to its original position quickly, whereas a fuse must be replaced when burned out. Sometimes a relay is used on one side of the line only, and here a fuse is required in the other side of the line. In such cases the rating of the fuse is commonly higher than the setting of the relay, thus causing the relay to open first and saving the fuse in ordinary cases.

The usual custom of setting overload protective devices to handle short interval peaks means, of course, minimizing or completely removing the protection against continuous overloads, which may not be so high as the short internal peaks but may ultimately hurt the motor on account of this duration. The wide variations of loads on the typical industrial motor, coupled with the feature just mentioned, mean that complete protection for such motors is difficult to realize, and indicate, moreover, the need for further development of overload devices.

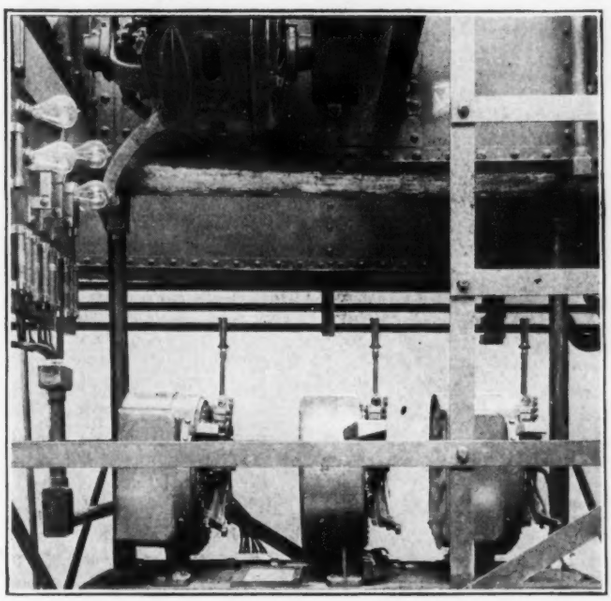


FIG. 3—PORTION OF POLYPHASE-OPERATED CRANE SHOWING CONTROL

THE FIELD-RHEOSTAT RELAY

One relay that has an interesting application to starting and operating conditions is the field-rheostat type shown in Fig. 4b. This relay is connected in such a way (in general as in Fig. 2) that the field rheostat is automatically short-circuited at such times as the armature current is above a prescribed value. With motors of the adjustable-speed type where speed control is accomplished through the adjustment of a field rheostat, it is obviously important to have full-field strength—that is, zero-field rheostat resistance—at starting, to insure a good starting torque and to protect the motor against excessive currents during the starting interval.

A reference to Fig. 2 shows that when the contact disk of the relay is raised by the action of a heavy armature current through the relay coil the resistance of the shunt-field rheostat is short-circuited. This action is especially important at starting if the field rheostat has been left set with its resistance in the field circuit. It is also useful if the motor happens to become heavily overloaded during its normal operation, since under such conditions the field rheostat is short-circuited as long as the overload lasts, causing the motor to operate at reduced speed, but automatically bringing it up to its set speed again when the overload is removed.

One of the principal advantages of the field-rheostat relay is the freedom it gives to the operator to set the field rheostat so as to produce the most economical speed for his machine tool, and then to leave it untouched during successive starting intervals. Fig. 4b shows a panel containing the field rheostat relay only.

CLASSIFIED LIST OF PROTECTIVE RELAYS

Application	Relay Type	Operation
For storage batteries and direct-current apparatus	Direct-current overvoltage	Prevents overcharging and damage from excessive voltage
For storage batteries and rotary converters	Direct-current reverse-current	Prevents discharge into charging source and protects against reversal of energy flow
For direct-current motors	Low-voltage release	Operates if voltage falls below a given value
For storage batteries	Direct-current overload	Disconnects when charge is completed
For feeders, motors, rotary converters and transformers	Alternating-current overload	Protects against overload
For feeders and generators	Alternating-current overload and reverse load	Protects against overload and reversal of energy flow
For induction motors	Alternating - current low voltage	Protects against fall in line voltage
For synchronous apparatus	Alternating-current reverse phase	Protects against reversal of phase progression

THE FLUTTERING RELAY

Automatic controllers for direct-current planer equipment involve an application of the relay somewhat like the one just described. The motor for the planer, whether for reversing or for non-reversing operation, may have two field rheostats, one being placed in circuit by the forward action of the master switch and the other becoming operative with the master switch in the reverse direction. The fact that the cutting stroke is usually made at a moderate speed and the reverse stroke at a considerably higher speed means that the motor operates with a strong field; that is, with little or no field rheostat resistance in the field circuit during the cutting stroke. At the end of the cutting stroke the field rheostat is automatically cut into the field circuit for producing the higher return-stroke speed.

The sudden change from a strong to a weak field is likely to produce excessive armature currents at the point of the planer reversal and during its acceleration for the reverse stroke. The addition of a field relay automatically furnishes the means for a gradual reduction of the field strength with each reversal of the

master switch, as follows: A rise of current above any prescribed value for which the relay is set causes the relay to close and thus short-circuits the field rheostat and tends to produce the full field strength for a brief interval. As soon as the armature current again falls below the given set value the relay opens the short-circuit across the field rheostat, thus inserting full-field rheostat resistance in the field circuit again. The back-and-forth action of the relay causes the field to fall to its lowest value without unduly high armature currents and is equivalent to a gradual increase of the resistance inserted in the field circuit, the usual name for this type being the "vibrating" or "fluttering" relay.

USE OF TRANSFER RELAY WITH ADJUSTABLE-SPEED MOTORS

The fluttering relay is equally applicable to the operation of any adjustable speed motor, its action being desirable in passing from the minimum to the higher speeds in such motors. The action of the relay is similar to that of a voltage regulator.† Tests on the smaller motors seem to indicate, however, that the action of such a relay is not very smooth. A second objection to its use lies in the fact that if the speed of an adjustable-speed motor is suddenly reduced from a high to a low speed, the temporary generator action of the motor may cause a large reverse current, thus lifting the relay, increasing the strength of the motor field and still further increasing the armature current. Thus the effect of the relay is essentially opposite to that experienced in the acceleration of the motor.

One way of overcoming the difficulty outlined with the fluttering relay is to employ a second relay with a winding so arranged as to reverse the connections leading to the fluttering relay in case the motor regenerates at any time. The second or auxiliary relay is known as a transfer relay and is required only in those cases where the change of field-rheostat resistance is rapid. Some interesting discussion on the fluttering relay may be found following the Institute paper referred to in the footnote on this page.

OTHER USES OF RELAYS

Among other uses of relays for industrial motors is that of the transition relay in automatic compensators for starting induction motors. Two coils are used in one type of transition relay, one in shunt and the other in series with the motor. The action of the relay in such a case is to disconnect the motor automatically from the transformer and to place it directly on the supply mains as soon as the motor-starting current falls to some given value which causes the action of the shunt coil to exceed that of the series coil in the relay.

Overload relays, sometimes termed "jamming" relays, may also be used in special cases for automatically placing the starting resistance in the motor armature circuit in case of overload, for the purpose of avoiding a reduction of the torque to zero even under excessive overloads.

There are a number of other protective devices adapted to the operation of motor-driven apparatus, such as the phase-failure and phase-reversal protective equipment illustrated above, which is to safeguard the operation of polyphase motors in case of failure of any one of the phases, phase reversal, or excessive drop in line voltage. The cut shows a type of mechanically operated safety device, this case referring to a safety limit stop to prevent overtravel of the hook block in crane operation. Many safety devices of this general form have been developed for avoiding difficulties which are likely when the personal judgment of the operator is relied upon as the sole protection of the apparatus.

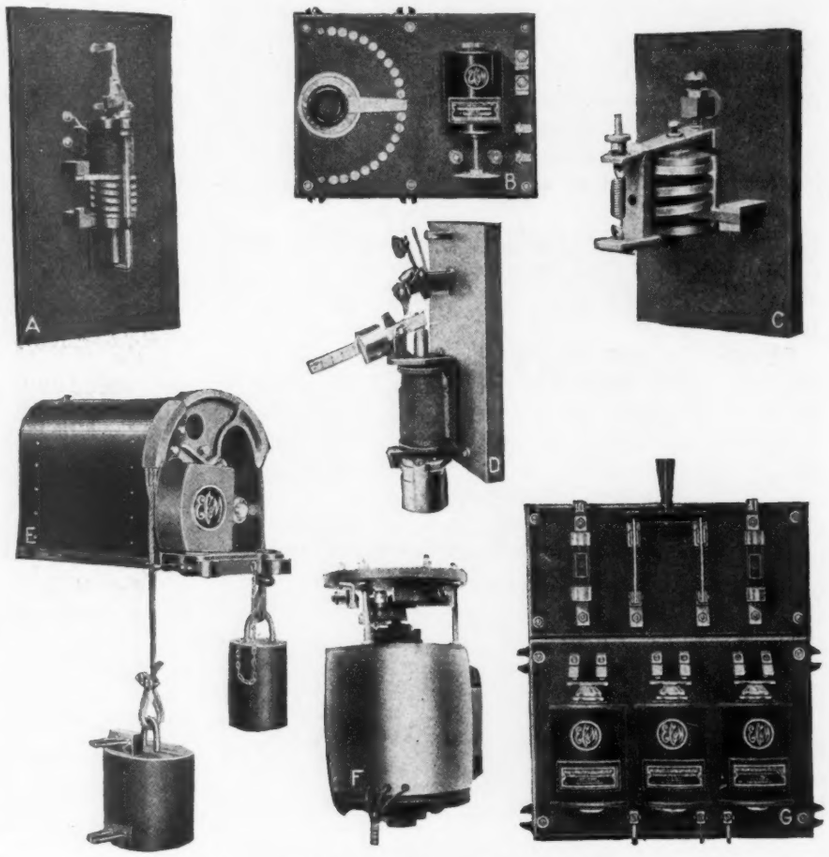
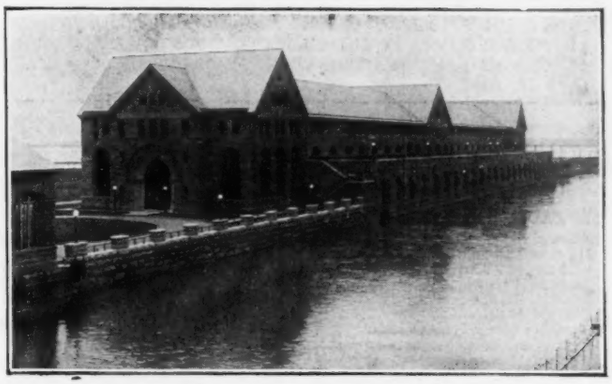


FIG. 4—OTHER APPLICATIONS OF RELAYS

A—Double-coil overload relay; B—Field-rheostat relay; C—Direct-current series relay for current control during acceleration; D—Time-element type of overload relay with hand-operated reset; E—Safety-limit stop for crane overtravel: F—Phase-failure and phase-reversal protective device; G—Series-wound relays for motor starting.

BIBLIOGRAPHY.—*Electric Journal*, January, 1917, p. 35; March, 1917, p. 103; May, 1917, p. 196; data of the Westinghouse Electric & Manufacturing Company, and bulletins or data of the Cutler-Hammer Manufacturing Company, the Electric Controller & Manufacturing Company, the Condit Electric Manufacturing Company and the Wagner Electric Manufacturing Company.

†See paper by H. D. James, *Transactions A. I. E. E.*, Vol. 36, p. 265.



Niagara Power in War Industries

HOW valuable a service is rendered to war industries by central stations in the Niagara district is told concretely and convincingly in a report to Secretary of War Baker just made public. The report is signed by Robert J. Bulkley and Brig. Gen. Charles Keller of the Corps of Engineers. Acting under orders from the Secretary of War, they have been exercising supervision over the supply of electrical power since November, 1917, in the portion of western New York in which Niagara Falls hydroelectric power is used.

On Dec. 8, 1917, Mr. Bulkley and General Keller submitted to the Secretary of War a preliminary report outlining a general plan under which they proposed to proceed, its underlying principle being the distribution of the hydroelectric power generated on the American side at Niagara Falls and that imported from Canada as completely as possible to war industries, giving them preference in the order of their importance as communicated by the War Industries Board.

Secretary of War Approves Plan

Approving the general plan, Secretary Baker on Dec. 28, 1917, signed requisition orders directed to the Hydraulic Power Company and the Niagara Falls Power Company, under the terms of which all power generated or imported by these two companies was requisitioned by the United States and directed to be distributed to consumers named. "Both companies," says the report of Mr. Bulkley and General Keller, "obeyed these orders loyally and have since then been disposing of all the electric power under their control in exact accordance with the instructions of your representatives."

Owing to certain practical difficulties of operation and distribution and to some misapprehension on the part of all concerned, it has been necessary from time to time to modify the schedules first issued. The Defiance Paper Company, taking power from the Hydraulic Power Company, and the International Paper Company, diverting water from the intake canal of the Niagara Falls Power Company, were deprived of all power, under the original orders. Arrangements were sanctioned for the installation by these companies of furnaces for the production of ferro-silicon. Both companies have completed their installations, their power has been restored to them, and they are now producing ferro-silicon.

The power imported from Canada by the Niagara, Lockport & Ontario Power Company and that which it generates at its steam station at Lyons, N. Y., and its hydroelectric stations at Salmon River and Minetto, N. Y., were not requisitioned by the United States. Explaining this arrangement, the report says:

"As the company had few large industrial users on its lines, a complete rearrangement of the allotment of this power did not appear necessary, and owing to the willingness of the company to co-operate in our plans, it seemed preferable to treat this company with less formality and to secure such adjustments as were needed by means of frequent and friendly conferences with its officials, whose advice we have found to be helpful and disinterested.

"This company operates over an extended territory, from Syracuse on the east to Erie on the west. Many public utilities are on its lines, the largest being the Rochester Railway & Light Company and the Syracuse Lighting Company. The former has a steam station at Rochester and a hydro station on the Genesee River, and the latter has a steam plant at Syracuse. Under arrangements suggested by the Niagara, Lockport & Ontario Power Company, at times of most pressing need additional steam power has been produced at Rochester and Syracuse and made available for use at Niagara Falls. The result of our arrangements with the Niagara, Lockport & Ontario Power Company was to curtail many minor and non-essential industries and to assign the power so saved to the Union Carbide Company for the production of ferro-silicon."

Conditions in City of Buffalo

Conditions in Buffalo are also discussed by Mr. Bulkley and General Keller in the report. The Buffalo General Electric Company, with a steam station of 30,000-hp. rating, receives normally also 51,000 hp. of Niagara Falls power and distributes it to the varied industries of the city of Buffalo. Except so far as this company was involved in the requisition order upon the Niagara Falls Power Company, no attempt was made to commandeer its output, but, as in the case of the Niagara, Lockport & Ontario Power Company, it was deemed best to take advantage of the company's intimate knowledge of the local situation and through its co-operation to secure such a reassignment of its output as, while affording the maximum gain of power for war industries, would at the same time to the slightest degree damage the diverse and usually small local industries dependent on this company.

"In a general way the policy suggested by the company and applied by us," write the representatives of the Secretary of War, "has been to remove from the peak hours all load possible, thereby freeing a corre-

sponding amount of continuous power, part steam, part hydroelectric, for use at Niagara Falls. In the case of some industries, such as brewing and malting, the denial of peak power has had the effect of compelling all operations to cease save as independent steam plants may have been available with fuel on hand."

Accompanying tables, which are taken from the report, refer to normal operating conditions, when the full output of the companies named is available. During the past winter the excessive and long-continued cold weather caused the hydroelectric companies great difficulties because of the formation of ice in their intakes, thereby reducing the flow of water and correspondingly the output of power. These difficulties were of unprecedented magnitude at Niagara. A typical diagram, reproduced on page 111, illustrates the extent to which the output of all the companies was reduced. At the same time correspondingly increased demands were necessarily made on the steam stations everywhere in the territory between Syracuse and Erie, while fuel supplies, which had been at a low ebb because of abnormal war activities, grew lower and lower. "At one time, indeed," says the report, "the Buffalo General Electric Company had less than a day's supply in reserve. By means of constant application to the Fuel Administration, practically daily in fact, we were enabled to keep the steam stations at Buffalo, Rochester, Lyons and Syracuse in uninterrupted operation, and to this extent the exercise of the authority confided by you in us helped to avert a public calamity."

Coal is criticised now as being of very poor quality, full of stone and foreign matter. It produces less steam per unit used, more ash and refuse, requires more labor in firing and more cars, engines and railroad men for its transportation, while at the same time generating less power than is the case under reasonably normal conditions. Mr. Bulkley and General Keller comment:

"It would seem possible, without very great effort, to better the quality of the coal output. The benefit of so doing would be very great."

Difficulties caused by ice or shortage of coal were met by cutting off all but the essential industries and by supplying the latter with power in order of preference indicated in the schedules approved by Secretary Baker. The period of acute shortage caused by ice ceased about March 1. Since then the beneficial results of regulation and controlling the distribution of power have become apparent.

As a result of the intervention of the national authorities accurate knowledge was obtained of the uses of power generated in this country in the Niagara

TABLE I—USE OF ELECTRIC ENERGY AS PRODUCED DURING TYPICAL PERIOD IN WINTER OF 1917-1918 (IN PER CENT OF TOTAL OUTPUT)

	Niagara Falls Power Co.	Hydraulic Power Co.	Niagara, Lockport & Ontario Power Co. Niagara & Erie Power Company	Buffalo General Electric Co.
Direct war industries	73.53	97.05	58.31	50.27
Transportation purposes	11.55	....	21.21	21.47
Street, commercial and residence lighting, water supply	7.81	1.95	7.61	13.99
Commercial power consumers over 100 hp.	1.52	0.13	5.94	2.82
Small commercial power	3.61	0.78	6.80	7.49
Non-essential purposes	1.98	0.09	0.13	3.96

TABLE II—DISTRIBUTION OF ELECTRIC POWER OF THE HYDRAULIC POWER COMPANY AND NIAGARA FALLS POWER COMPANY BEFORE AND AFTER APPLICATION OF ORDER OF SECRETARY OF WAR, DEC. 28

Company Taking Power	Use of Power (Hp.), November, 1917	Reapportionment of Power (Hp.), Increase	Reapportionment of Power (Hp.), Decrease	Distribution of Power (Hp.), March, 1918
HYDRAULIC POWER COMPANY:				
Aluminum Company of America	65,866	.....	6,000	59,866
Ice companies	473	.....	223	250
Cliff Paper Company	3,291	.....	3,291	0
Defiance Paper Company	2,034	.....	2,034*	0
Frontier Brick Company	36	.....	36	0
General Abrasive Company	1,706	.....	.....	1,706
National Electrolytic Company	2,892	.....	.....	2,892
Union Carbide Company	37,000	5,500	.....	42,500
Hooker Electrochemical Company	6,534	.....	.....	6,534
Isco Chemical Company	591	600	.....	1,191
National Carbon Company	2,477	2,184	.....	4,761
Niagara Alkali Company	5,714	300	.....	6,014
Oldbury Electrochemical Company	3,000	3,000	.....	6,000
United States Light & Heat Corporation	1,319	.....	.....	1,319
Titanium Alloy Manufacturing Company	7,074	.....	.....	7,074
Other smaller companies	4,514	.....	.....	4,514
	144,621	11,584	11,584	144,621
NIAGARA FALLS POWER COMPANY:				
Buffalo General Electric Company	35,282	.....	9,100	26,182
Niagara River Manufacturing Company	880	.....	880	0
International Paper Company	3,000	.....	3,000*	0
Acheson Graphite Company	5,408	2,500	.....	7,908
Hooker Electrochemical Company	9,165	.....	.....	9,165
Isco Chemical Company	709	.....	.....	709
Mathieson Alkali Company	10,343	1,407	.....	11,750
Niagara Electrochemical Company	9,506	4,000	.....	13,506
Niagara Alkali Company	1,363	.....	.....	1,363
Oldbury Electrochemical Company	2,654	.....	.....	2,654
Star Electrode Works	4,083	1,600	.....	5,683
Carborundum Company	10,483	2,217	.....	12,700
Union Carbide Company	16,533	1,256	.....	17,789
Other smaller companies	23,935	.....	.....	23,935
	133,344	12,980	12,980	133,344

*Later returned to paper company when it began manufacture of ferro-silicon.

TABLE III—NIAGARA FALLS-BUFFALO DISTRICT—INCREASED ALLOTMENTS OF POWER (HP.) TO ELECTROCHEMICAL INDUSTRIES IN APRIL, 1918, AS COMPARED WITH POWER USED IN NOVEMBER, 1917, UNDER NORMAL CONDITIONS.

Manufacturers and Power Companies	Product —Ferro-Silicon— Nov., '17	Apr., '18	—Electrodes— Nov., '17	Apr., '18
Union Carbide Co.—Hydraulic Power Co., Niagara Falls Power Co., Niagara, Lockport & Ontario Power Co	66,867	78,964	.....	.....
Defiance Paper Co.—Hydraulic Power Co	0	*2,034	.....	.....
International Paper Co.—Niagara Falls Power Co	0	*3,000	.....	.....
U. S. Alloys Co.—Buffalo General Electric Co	6,720	9,176	.....	.....
	73,587	93,174	.....	.....
Increase	.....	19,587	.....	.....
National Carbon Co.	.....	.....	2,577	4,761
International Ach. Graphite Co.	.....	.....	5,408	7,908
Star Electrode Works	.....	.....	4,083	5,683
	.....	.....	12,068	18,352
ncrease	.....	.....	.....	6,284

	Product —Silicon— Nov.,'17	Apr.'18	Phosphorus, Etc. Sodium-Cyanide Nov.,'17	Apr.,'18	Chlorine, etc. Nov.,'17	Apr.,'18
Carborundum Co. of America	10,483	12,700	.....	.....	.....	.....
Increase	.....	2,217	.....	.....	.....	.....
Oldbury Electrochem. Co.	.....	.....	5,654	8,654	.....	.....
Increase	.....	.....	.....	3,000	.....	.....
Niagara Electrochemical Co	.....	.....	9,506	13,506	.....	.....
Increase	.....	.....	.....	4,000	.....	.....
Mathieson Alkali Co.	.....	.....	.....	.....	10,343	11,750
Isco Chemical Co.	.....	.....	.....	.....	1,300	1,900
Niagara Alkali Co.	.....	.....	.....	.....	7,077	7,377
Niagara Smelting Co.	.....	.....	.....	.....	1,125	†1,319
					19,845	22,346
Increase	.....	.....	.....	.....	.....	2,501
Total increase	.....	.....	.....	.....	.....	37,589

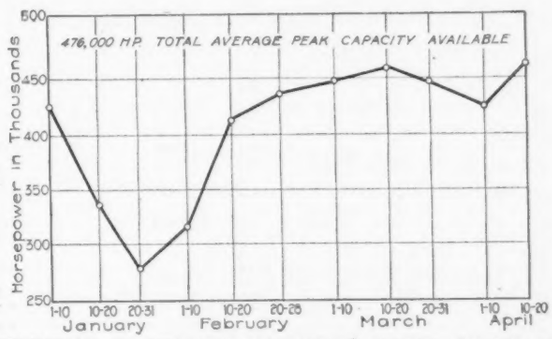
*Used by Union Carbide Company until April, when paper company began ferro-silicon manufacture.
†Power supplied by Niagara, Lockport & Ontario Power Company.

Falls district and that imported from Canada. This information shows that practically all the power available is used to the advantage of the prosecution of the war, as appears in an accompanying table.

In discussing the need of more power in the district the report says:

Disregarding the abnormal shortage of power in the Niagara and Buffalo district during the past winter, under war conditions the power supply falls short of the demand by about 200,000 hp. This estimate is not based on new industries coming into the district, but is determined as the amount of power which could be absorbed by the industries now operating were such a supply available. A large part of this amount would be absorbed without the addition of new industrial equipment by the users.

Some of this shortage will be relieved next fall by the proposed enlargements of the steam plants of the Buffalo General Electric Company and the Niagara, Lockport & Ontario Power Company. These two companies are now making additions to their plants aggregating 62,000 hp.



REDUCTION IN NIAGARA COMPANIES' OUTPUT CAUSED BY ABNORMAL WINTER

By means of a further development by the American hydro-power companies at Niagara Falls their existing supply of power, amounting to about 250,000 hp., will be increased by about 160,000 hp.

To enable us to administer this power situation efficiently, we have caused to be permanently assigned to duty at Buffalo Capt. R. S. Hardy, Engineers R. C. He is in close touch with the managers of the various companies concerned, and his services have been most helpful in arriving at correct solutions of the difficulties frequently arising. His assignment to this duty should be continued as one of the most helpful measures in keeping the matter under satisfactory control.

It further seems necessary to arrive at the greatest possible degree of certainty that the fuel supply of the important steam power plants in this territory will be maintained. We have already approached the Fuel Administration and hope to secure its early co-operation to this end.

False Economy

The Wall Street *Journal* editorially refers to the plan of saving coal by reducing domestic consumption of gas and electricity as follows: "A plan to save coal by reducing domestic consumption of gas and electricity one-half assures a minimum of result at a maximum of discomfort. It has this additional feature, not at all pleasant to contemplate: It will bear hardest upon those least able to bear hardship. People of small means who cook by gas and light their rooms with it or electricity are not apt to burn more than is absolutely necessary. On May 31 Bradstreet's price index of foods, based on thirty-one articles, was 4.24 compared with 4 a year ago. Some articles are double their 1913 price, and it is these that families of limited means must purchase."

EFFECTS OF PRESENT CONDITIONS ON COST OF LINE CONSTRUCTION

Poles, Wire and Labor Advance 10 to 90 per Cent in Four Years—Good Management Has Kept Construction Costs from Rising so Fast

BY A. G. HURD

TO DETERMINE the effect which the constantly increasing cost of material and labor has had on the total cost of line construction, the records of a public utility company were analyzed recently, the observations being given in the accompanying tables. That these costs of construction did not keep pace with the prevailing market price of material is due to several factors, among them good judgment and scientific management. For the sake of comparison Table I gives the average market price which this company paid for material and labor from 1915 to May, 1918, and shows the increase in percentage of the 1915 figures.

TABLE I—INCREASE IN COST OF MATERIAL AND LABOR

Year	Wire, Per Cent.	Poles and Equipment, Per Cent.	Labor, Per Cent.
1915	100	100	100
1916	125	105	120
1917	174	110	150
1918	170	110	190

If all purchases were made at the time of construction and the jobs were similar—i.e., the poles erected in the same kind of earth, etc.—the cost of construction in the various years would follow the increase shown in Table I. In actual practice, however, all one-pole line extensions are not alike in length, difficulty of erection and other labor items. Data indicating the actual cost of one-pole, two-pole and three-pole line extensions, from 1915 to May, 1918, are given in Table II. A one-pole line extension would consist, under this definition, of one two-wire span of approximately 100-ft. (30.5 m.) and one 35-ft. (10.7-m.) pole with cross-arm, braces, bolts, pins and insulators. Practical conditions will cause a variation from this standard in length of wire, number of cross-arms (one or two), bolts, etc. However, if sufficient examples of approximately the same class of construction are grouped a very fair average of the actual cost of the work over any time may be obtained.

TABLE II—ACTUAL EXTENSION COSTS AND RELATION TO 1915 VALUES OF THREE POLE-LINE EXTENSIONS

Year	Wire Cost	Wire Per Cent.	Poles and Equipment Cost	Poles and Equipment Per Cent.	Labor Cost	Labor Per Cent
1915	8.15	100	10.36	100	3.39	100
1916	9.07	111	10.91	105	5.11	150
1917	9.19	113	10.90	105	5.70	168
1918	11.39	140	10.80	104	6.58	194
1915	13.20	100	20.77	100	7.50	100
1916	15.76	119	19.68	95	7.89	105
1917	17.60	133	20.92	100.5	9.19	123
1918	16.97	129	20.97	101	9.34	125
1915	19.18	100	29.82	100	11.33	100
1916	22.25	116	30.07	101	13.51	116
1917	23.30	121	30.40	102	13.51	120
1918	23.45	122.4	31.50	106	14.28	126

An inspection of the table shows that the increasing cost of extension materials has lagged behind the market increase in these commodities owing to advantageous purchasing and the use of stock on hand. Eventually these costs would meet the percentage of increase as shown by the market quotations. Likewise when prices begin to fall the percentage of decrease in cost of construction will lag behind the market prices unless this is

offset by careful purchasing and by not carrying too large a stock.

The fact that labor costs have increased less than the market price of labor may be chiefly accounted for in two ways:

1. By the element of luck in the order in which extension came in. In this system there are several localities where layers of limestone or hard Utica shale are encountered one foot beneath the ground line. Blasting is not possible, and there have been cases where it cost more than $5 to dig the hole for a 35-ft. (10.6-m.) pole. Not much difficult ground has been encountered lately.

2. The other reason for lower actual costs was that the mounting cost of labor was met by more scientific planning of the work, jobs being grouped so that as little time as possible was wasted in getting from place to place and starting the actual work.

That the increasing cost of construction has forced the more scientific treatment of what were formerly considered small things is a compensation which should not be lost when prices again recede to more reasonable figures.

MANY WAR PROBLEMS WERE DISCUSSED BY THE A. S. M. E.

Worcester Convention Also Considered Fire Protection, Safety Engineering, Vocational Traning and other Timely Topics

Besides the papers and addresses noticed in the ELECTRICAL WORLD for June 15 as among those characterizing the Worcester (Mass.) convention of the American Society of Mechanical Engineers, many others filled the three-day session with interest.

A paper on "Some Economic Aspects of Fire Protection Problems and Hazards in War Times," by J. D. Pryor and F. V. Sackett, Providence, R. I., was read by title. The authors discussed the engineering principles of protection in metal-working establishments, textile plants, shipyards, piers, flour mills and grain elevators.

At a general session W. W. Bird read a paper describing the foundry cost and accounting system of the Worcester Polytechnic Institute commercial foundry; Lieut. J. L. Alden presented a paper on "A High-Speed Air and Gas Washer," and I. H. Cowdrey discussed the effect of moisture re-absorption on air-dried fir and hard pine. J. C. Smallwood read a paper on "The Uses of Steam in the Canning Factory," and Morris L. Cooke contributed a paper on "The Public Interests as the Bed Rock of Professional Practice."

One of the parallel sessions was devoted to safety engineering. L. A. De Blois of E. I. du Pont de Nemours & Company, Wilmington, Del., pointed out that over 80 per cent of industrial plant accidents are preventable and urged that the safety problem be treated from a thoroughly comprehensive engineering standpoint and that precautionary measures should not cease with the appointment of a safety inspector or committee. A remarkable point brought out is that about the same assignment for industrial accidents is found in the du Pont plant (manufacturing the most dangerous materials used in industry and war) as in the cement industry. It appears that neither the nature of the industry nor the character of materials produced or handled has as much effect on the cause, frequency and severity of accidents as the safe design of plants, proper organization, supervision and education.

A twenty-one-page memorandum was also presented at this session by the National Safety Council, covering the teaching of safety engineering.

On one of the evenings a general war session was held at the Hotel Bancroft, President Main being the first speaker. He emphasized the present opportunities for engineers to engage in government service, after which Prof. L. P. Breckenridge of Yale University took the chair and pointed out the vital importance of carrying forward technical education, even under war conditions. He urged that everything possible be done to maintain the supply of students for technical schools in the interest of the country's welfare. Dr. W. Irving Clark of Worcester told of recent experiences in France, and Paymaster C. E. Parsons, U. S. N., gave a brief address upon the work of the navy purchasing bureau staff.

At a morning session there was a general conference on fuel economy, the presiding officers being Professor Breckenridge and F. R. Low, editor of *Power*. The latest problems in boiler-plant practice were discussed at length.

Papers were presented by C. M. Allen and F. W. Roys on "The Efficiency of Gear Drives"; by H. G. Reist, on "A Self-Adjusting Spring Thrust Bearing"; by C. A. Briggs, W. C. Chapin and H. G. Heil, on "The Elastic Indentation of Steel Balls Under Pressure"; by F. Hymans, on "Stresses in Machines When Starting or Stopping"; by Morgan Brooks, on "Air Propulsion," and by Harold E. White, on "The Electric Heating of Molds." Messrs. Allen and Roys described a motor-driven apparatus for measuring gear losses directly by balancing the motor field against an Alden absorption dynamometer.

Mr. White gave the results of electric mold heating in a specially designed equipment in which the molds are magnetized with 60-cycle current, the molds being of steel and heated by the eddy currents and hysteretic losses. It is expected that the new method can be utilized in the production of die castings of readily fusible metal and also in drawing the temper of hardened-steel parts. The method was developed on account of the slow and frequently interrupted production obtained in manufacturing phenolic condensation products. The first coil was made of 100 turns of No. 6 wire (asbestos-covered) wired to a 220-volt supply line. With molds weighing 10 lb. to 15 lb. (4.5 kg. to 6.8 kg.) a curing temperature, starting cold, was reached in from three to five minutes. In the latest equipment the coils are arranged both above and below the mold. By the induction method it is possible to pile several thin molds on top of each other and heat them all at once, something out of the question with any other method.

The vocational training session was marked by addresses by Major Cassidy, U. S. N. A., Camp Devens, Mass., on "The Training of Officers for Service at and Behind the Front"; Arthur L. Williston of Boston, educational director of the New England committee on education and special training, War Department; Lieut. André of the French Military Mission, Northern District, Harvard University, and C. L. Homer, Fore River Shipbuilding Company, Quincy, Mass.

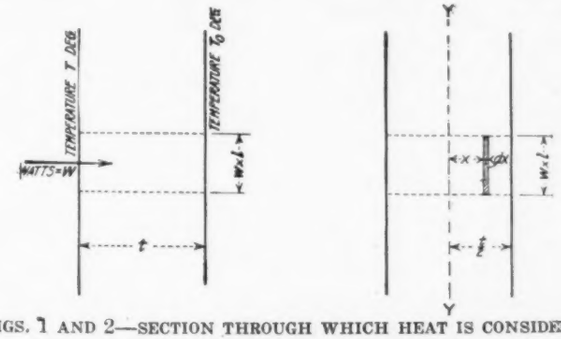
"Hottest Spot" Temperature in Transformers

Formula Developed for Calculating Maximum Temperature—Correction for Space Factor and Conduction Through Conductors Included—Application of Formula to Specific Case Illustrated

BY ALFRED STILL
Professor of Electrical Design, Purdue University

THE tendency on the part of designers of every kind of electrical machinery and apparatus is to make use of accumulated test data relating to similar apparatus when making calculations on new designs, which are usually but slight modifications of existing types and sizes. This procedure may be followed with comparative safety by the experienced engineer, who is usually a good guesser; but nevertheless occasions arise when calculations based on the fundamental principles of physics should be used, if only as a check on the designer's judgment and divination.

When testing transformers to ascertain whether the temperature is or is not excessively high, a thermometer placed at the hottest accessible part indicates approximately the temperature of the outside surface of



FIGS. 1 AND 2—SECTION THROUGH WHICH HEAT IS CONSIDERED AS BEING TRANSMITTED, AND A SIMILAR SECTION BUT WITH THE HEAT GENERATED WITHIN

the coils. It is customary to add 15 deg. C. to this recorded temperature and assume that the result will be the temperature of the hottest spot in the windings. This may or may not be the case, although in modern transformers it is probable that this figure is not often exceeded.

Although the internal temperatures of coils are not easily calculated, it is possible to develop approximate formulas which are easily applied and which, with slight modifications, may be used with advantage in predetermining the internal temperatures of many types of electrical windings. Before developing a practical formula for use in transformer design, it will be advisable to consider briefly the relation between fall of temperature and flow of heat through heat-conducting materials.

Fig. 1 is intended to represent a section through a very large flat plate, of thickness t, consisting of any homogeneous material. Assuming that a temperature difference, $T_d = T - T_0$ deg. C., is maintained between the two sides of the plate, the heat flow (expressed in watts) through a portion of the plate of area $w \times l$ can be calculated as follows: The resistance offered by the material of the plate to the passage of heat may be expressed in *thermal ohms*, the thermal ohm being defined as the thermal resistance which causes a drop of 1 deg. C. per watt of heat flow. In other words, if R_h is the thermal resistance of the heat path under consideration,

$$R_h = T_d/W \qquad (1)$$

which permits of heat conduction problems being solved by methods of calculation similar to those used in connection with the electric circuit.

Let k be the heat conductivity of the material, expressed in watts per inch cube per degree Centigrade difference of temperature between opposite sides of the cube, then the watts of heat flow crossing the area $(w \times l)$, indicated in Fig. 1, is

$$W = [(wlk)/t]\ T_d \qquad (2)$$

A similar case is illustrated in Fig. 2, but the heat is now supposed to be generated in the mass of the material itself. The plate is still considered to be very large relative to its thickness, so that the heat flow from the center outward will be in the direction of the horizontal dotted lines. A uniformly distributed electric current of density Δ amp. per square inch is supposed to be flowing to or from the observer, and the highest temperature will be on the plane YY' passing through the center of the plate. Assuming this plate to be of copper with a resistivity of 0.84×10^{-6} ohms per inch cube at a temperature of about 80 deg. C., the watts lost in a section of area $x \times w$ sq. in. and length l in. will be

$$W_x = (\Delta xw)^2 \times 0.84 \times 10^{-6} \times (l/xw)$$
$$= 0.84 \times 10^{-6} \Delta^2\, wlx \qquad (3)$$

By adapting formula (2) to this particular case, the difference of temperature between the two sides of a section dx in. thick is seen to be

$$dT_d = W_x \times dx/(wl \times k),$$

whence

$$T_d = \frac{0.84 \times \Delta^2}{10^6 k} \int_0^{\frac{t}{2}} x\,dx$$
$$= (0.84\ \Delta^2 t^2)/(8 \times 10^6 k) \text{ deg. C.} \qquad (4)$$

The value of k for copper is about 10 watts per inch cube per degree Centigrade.

PRACTICAL APPLICATION OF FORMULA

The problem of applying these principles to the practical case of a transformer coil is complicated by the fact that the heat does not travel along parallel paths as in the preceding examples, and, further, that the thermal conductivity of the built-up coil depends upon the relative thickness of copper and insulating materials, a relation which is usually different across the layers of winding from what it is in a direction parallel to the layers.

A section through a transformer coil wound with layers of wire in the direction OA is represented in Fig. 3, the number of layers being such as to pro-

duce a total depth of winding equal to twice OB. The whole of the outside surface of this coil is supposed to be maintained at a constant temperature by the surrounding oil or air. In other words, it is assumed that there is a constant difference of temperature of T_d degrees between the hottest spot (supposed to be at the center O) and any point on the surface of the coil.

The heat generated in the mass of material represented by Fig. 3 is thought of as traveling outward through the walls of successive imaginary spaces of rectangular section and length l perpendicularly to the plane of the section. $CDEF$ is the boundary of one of the imaginary spaces the walls of which have a thickness dx in the direction OA, and a thickness $dx\ (OB/OA)$ in the direction OB. According to formula (1), it can be stated that the difference of temperature between the inner and outer boundaries of this imaginary wall is dT_d = heat loss in watts occurring in the space $CDEF$ multiplied by the thermal resistance of the boundary walls.

Considering the heat flow through the portion of the boundary surface of which the area is $CDEF \times l$, and letting W_x stand for the watts passing through this area

$$dT_d = W_x \frac{1}{(2DEl k_a/dx) + (2CDlk_b)/(dxOB \div OA)}$$

This simplifies into

$$dT_d = W_x \frac{dx(OB/OA)}{2lx[k_a(OB/OA)^2 + k_b]} \qquad (5)$$

In order to calculate W_x it is necessary to know not only the current density, Δ, but also the space factor, or

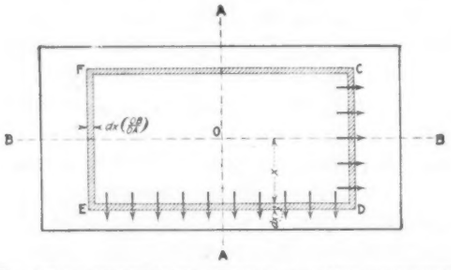


FIG. 3—HEAT GENERATED WITHIN A MASS CONSIDERED AS TRAVELING OUTWARD IN DIRECTION OF ARROWS

ratio of copper cross-section to total cross-section. Let a stand for the thickness of copper per inch of total thickness of coil measured in the direction OA; and let b stand for a similar quantity measured in the direction OB; the space factor is then $(a \times b)$, and

$$W_x = [\Delta \times 2x \times 2x(OB/OA) \times ab]^2 0.84 \times 10^{-6} l/[2x \times 2x(OB/OA)ab]$$

Inserting this value of W_x in (5), and making the necessary simplifications,

$$dT_d = \frac{0.84\Delta^2 ab}{10^6[k_a + k_b(OA/OB)^2]} xdx$$

whence, by integration between the limits $x = O$ and $x = OA$,

$$T_d = \frac{0.84\Delta^2 ab(OA)^2}{2 \times 10^6[k_a + k_b(OA/OB)^2]} \text{ deg. C.} \qquad (6)$$

Except for the obvious correction due to the introduction of the space factor ab, the only difference between this formula and formula (4) is that the thermal conductivity, instead of being k_a as it would be if the heat flow were in the direction OA only, is replaced by the quantity in brackets in the denominator of formula (6). This quantity may be thought of as a fictitious thermal conductivity in the direction OA, which, being greater than k_a, provides the necessary correction due to the fact that heat is being conducted away in the direction OB, thus reducing the difference of temperature between the points O and A.

CALCULATION OF k_a AND k_b

Let k_c and k_i respectively stand for the thermal conductivity of copper and insulating materials as used in transformer construction. The numerical values of these quantities, expressed in watts per inch cube per degree Centigrade, are $k_c = 10$ and $k_i = 0.0033$. It follows that

$$k_a = \frac{1}{(a/k_c) + [(1 - a)/k_i]} = \frac{10}{a + 3000(1 - a)} \qquad (7)$$

and similarly,

$$k_b = 10/[b + 3000(1 - b)] \qquad (8)$$

where a and b are the thickness of copper per inch of coil in the directions OA and OB respectively, as previously defined.

Example.—To illustrate the use of the formula, suppose that a transformer coil is wound with 0.25 in. by 0.25 in. (6.4-mm. by 6.4-mm.) square copper wire insulated with cotton 0.01 in. (0.254 mm.) thick and provided with extra insulation of 0.008 in. (0.2 mm.) fuller board between layers. There are twelve layers of wire and seven wires per layer. Assume the current density to be 1400 amp. per square inch, and calculate the hottest spot temperature if the outside surface of the coil is maintained at 75 deg. C.

$a = 0.25/0.27 = 0.926$; $b = 0.25/0.278 = 0.9$; whence space factor $ab = 0.833$. By formulas (7) and (8), $k_a = 0.0448$, and $k_b = 0.0332$. $OA = 3.5 \times 0.27 = 0.945$, and $OB = 6 \times 0.278 = 1.67$ in. By formula (6),

$$T_d = \frac{0.84(1400)^2 \times 0.833(0.945)^2}{2 \times 10^6[0.0448 + 0.0332(0.945/1.67)^2]} = 11 \text{ deg. C.}$$

and the hottest spot temperature = 75 + 11 = 86 deg. C.

It is not possible to single out any one industry or product and say of it, this is the most important for the winning of the war. We may truly say that the most important element is the spirit of the soul of the people—the morale of the nation—but in dealing with our industrial life we have absolute need of many things. Food we must have or perish; steel, copper, chemicals, machinery, coal—we have need for all of these and more, or we must suffer defeat. Ranked with these and just as important a factor must be placed the electrical industry in its many phases of usefulness. What is there that man is making or doing for the cause of democracy and freedom "over there," or over here, which does not in some measure depend upon light, heat or the power of electricity?—*Thomas Fuller, Westinghouse Electric & Manufacturing Company, before Tri-State Water and Light Association.*

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

METER READINGS FACILITATED BY USE OF PORTABLE TABLE

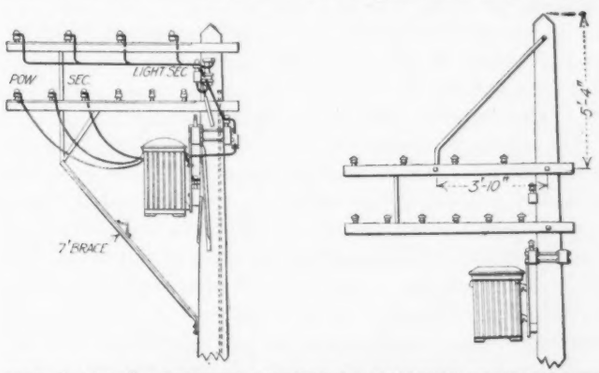
Holds Daily Report and Can Be Moved in Front of Switchboard on Which Meter Is Placed, Reducing Chances of Error

In many power plants that are equipped with bench-board control for operating switches considerable trouble is entailed in recording the readings of meters installed on a long switchboard. The switchboard operator usually writes the readings on a piece of scrap paper and then some time during the interval of readings he copies the figures on the standard daily report. To eliminate the time wasted in copying the readings and to reduce the possibility of error in handling the figures twice, a company in the Southwest constructed a light table supported on wheels so that it can be easily moved. The top of this table holds the daily report sheet. The operator starts at one end of the line of instruments and records the indications of the meter, at the same time moving the table along so that it is directly opposite the meter whose reading is being recorded.

MORE TRANSFORMER SPACE ON DISTRIBUTION POLE

Overhead Bracing Method Permits Transformers of Any Size up to 100 Kw. to Be Hung on Poles—First Cost Lowered by This Method

As loads on distribution lines increase, transformers that were considered sufficiently large at first often turn out to be far short of present requirements. If transformers of larger size are required, it may happen



FIGS. 1 AND 2—PRESENT METHOD OF HANGING TRANSFORMERS AND PROPOSED METHOD OF BRACING CROSS-ARMS

that there is not room on the pole between the cross-arm and the brace. In order to eliminate this difficulty, a company in the Middle West is considering the advisability of changing its standard, which is shown in Fig. 1, to that shown in Fig. 2.

As may be observed, the proposed change consists of eliminating the arm brace under the cross-arms and installing a lighter brace above the arms. Of course, if the former clearance is to be maintained longer poles must be used, but it is thought by the company that the cost will not be increased because the pole top will not have to be as large as formerly. Besides, the size of the pole at the gains will be the same. Furthermore, the brace can be made from smaller stock because it will be in tension instead of compression.

The result will probably be that the first cost will be lowered, although this is not the main consideration. One feature is that it will be easier to hoist transformers on the poles on account of the increased height of the pole. Transformers as large as 100-kw. rating can be installed on these poles, whereas with the old construction the extreme maximum is 50 kw.

AUTOMATIC APPARATUS TO LIMIT PEAK LOADS

Power Indicating and Limiting Apparatus on St. Paul Electrified Railroad Assists in Securing Minimum Rate

The contract under which the Chicago, Milwaukee & St. Paul Railway is supplied with power for the operation of its electrified division is based on a 60 per cent load factor, with the provision that the load is not to exceed an average value of 12,000 kw. in any five-minute period. Under these conditions it is very desirable to maintain a high load factor, and to this end a unique scheme has been devised and special instruments developed which have increased the load factor from 40 to 60 per cent.

The power indicating and limiting system for securing this result consists of a 1200-volt circuit running from the first to the last substation and fed from a very small motor-generator in the load dispatcher's office. In each substation where there is a power-company feed tap there is installed a contact-making wattmeter, which introduces into the power indicating and limiting circuit an additional ohmic resistance whose amount varies with the load supplied at the feeder tap. In each substation there is also automatic apparatus which, when the total kilowatts used in the system reaches the amount contracted for and consequently when the current in the power indicating and limiting circuit reaches a certain value, causes resistance to be inserted in the fields of the substation generators of the motor-generator sets.

This reduces the voltage on the trolley system, causing the speed of all trains to be decreased. The maximum reduction in load thus obtained is about 30 per cent of that which would be used in case the power indicating and limiting system were not provided. The apparatus is so arranged as to reduce the voltage of the most

heavily loaded substations first, and also to reduce the voltage of any individual substation so as to throw the load on the other substations when the load on such substation reaches the particular amount for which the apparatus may have been adjusted.

In the dispatcher's office there is a switchboard on which is mounted apparatus for controlling the small motor-generator set supplying the system, and also indicating and curve-drawing wattmeters which show for any instant the total kilowatts supplied by the power company. This work, like other electrical features of the St. Paul electrification, is in immediate charge of R. Beeuwkes, electrical engineer.

EXTINGUISHING FIRES IN TURBO-GENERATORS

Water Directed to Windings from Pipes in Rotor End Bell Serves as Emergency Extinguisher Until Cover Can Be Removed

BY J. T. FOSTER

The enormous demands for industrial load now being imposed on electric power companies have brought about the policy of keeping at a maximum the output of every available piece of apparatus, which necessitates that the operating engineer shall be prepared for occasional burn-outs by making plans for such emergencies.

The burn-out of a turbo-generator is extremely serious under present conditions and may mean that a generator will be out of service for several months for rewinding. If the fire is detected and promptly put out, the damage may be limited to one or two coils, which may be quickly replaced. The tendency of fire

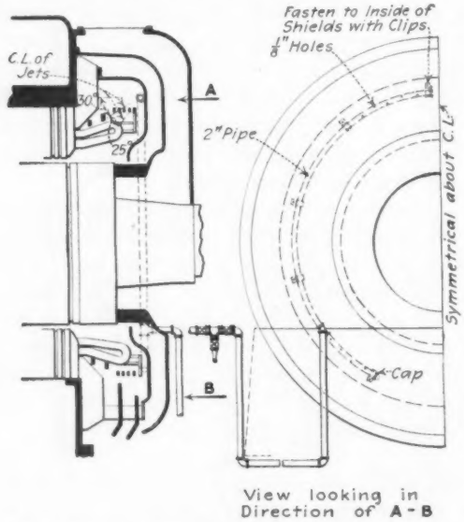


FIG. 1—FIRE-EXTINGUISHING PIPES FASTENED WITH CLIPS TO GENERATOR END BELLS

to spread rapidly through the generator windings is great because of the velocity of the cooling air.

Among the extinguishing agents proposed for the rapid extinguishing of fires have been carbon tetrachloride, carbon dioxide, steam and water.

The first three are all more or less effective if used in sufficient quantities, but they offer some objections because carbon tetrachloride and carbon dioxide are injurious when breathed by the station attendants, because carbon tetrachloride may react chemically and disintegrate the coil insulation, and because live steam may bake out the coil insulation and permanently weaken it. The foregoing disadvantages have led operating engineers to use water as the extinguishing agent because there are no objections to its use except when it is used in excessive quantities.

Where a machine is so designed that the end bells

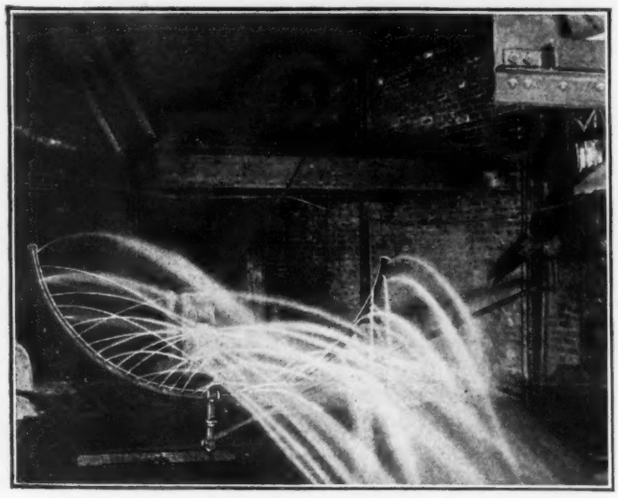


FIG. 2—SPRAY PIPES BEING TESTED BEFORE INSTALLATION IN GENERATOR

can be readily removed, the fire does not usually progress to a point where the destruction of the coils becomes general, because the machine can be quickly uncovered and water applied. When the design does not permit of the ready removal of end bells, or the casing does not have handholes, however, it may happen that before the attendants can use any means of fire extinguishing the stator or rotor will be completely burned out.

The attempt to smother the fire by closing the inlet and outlet dampers, while helpful, is not entirely effective, and for this reason automatic dampers should not be installed, because they would not remedy conditions materially and would introduce a serious element of danger. Cutting off the machine excitation, while a necessary step, is of minor importance, and the benefits which would be obtained from automatic relays would not compensate for the attendant danger. Time is the most important factor entering the problem.

Of course it is necessary to disconnect the machine from the bus, cut off the excitation and shut down the steam end when a fire starts, but it is also necessary to use some more positive means of smothering the fire. One form of apparatus for doing this consists of a ring of 2-in. (5-cm.) pipe fastened with clips to the inner surface of the generator end bells, as shown in Fig. 1. This pipe is drilled, the holes being $\frac{1}{8}$ in. (0.3 cm.) in diameter and staggered to obtain a proper distribution of water from the jets. Water under 5 lb. pressure (351 gm. per sq. cm.) is piped to the ring, and admission thereto is controlled by a hand-operated valve which is readily accessible in an emergency. This apparatus serves only for the emergency purpose of preventing the fire from spreading. However effective it may be from this point of view, it will still be necessary in any event to uncover the machine and use a hose to extinguish the fire.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

INTERESTING RANGE POLICY OF COMPANY IN SOUTHWEST

Figures That All Extensions Made at the Present Time Can Be Made to Pay if Man Who Wires House Buys Electric Range

A central-station company in the Southwest, operating in a city which is enjoying considerable building activity at the present owing to the oil boom, has adopted an interesting policy in regard to electric range sales. While this company's sales department on the whole is somewhat depleted, it has continued to let one man devote his time entirely to selling electric ranges. He spends his efforts principally in working on the builders of new homes. The company figures that it will have to serve these homes with electric light, which will necessitate running a service, and that it might as well get a customer who will give it $50 a year revenue as one who will only give it $18. The company is also of the belief that the difference in cost of running a service for a lighting load and running a service for a range load on new construction is not material. Hence it keeps this man "plugging away" on home builders, endeavoring to sell them the electric cooking idea and to get them to install an electric range as a part of the original equipment.

EXPERIENCE OF A KANSAS COMPANY IN HIRING WOMEN

For the Same Amount of Work More Women Are Required than Men, but Cost of Operating Department Remains Practically the Same

W. A. Wadsworth, manager of the Kansas Gas & Electric Company, Wichita, Kan., speaking on the tendency of central-station companies to displace young men of the draft age with female employees, stated that in the experience of his company it takes about five intelligent women to replace four men on the ordinary sort of central-station routine work. It is figured that about one out of every twelve women will be absent every day. Moreover, the rate of turnover of labor is somewhat increased, so that it is necessary to keep a certain percentage of additional help to fill in gaps which are caused by positions being suddenly vacated.

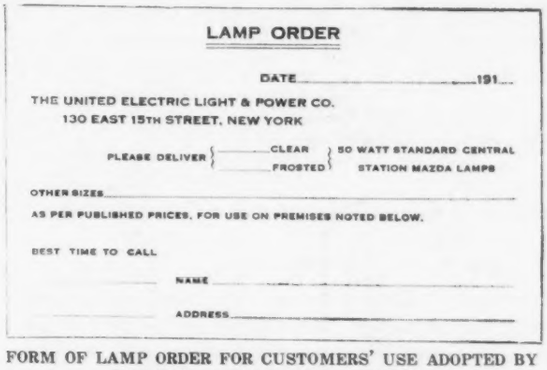
The company now has twenty-five employees in its accounting department and all but three of these are women. Formerly the proportion of men and women in this department was reversed. The same thing prevails in the application department, which has about twelve employees. The company also expects to employ women as collectors, but does not believe it will be possible to use them for meter reading.

The experience indicates thus far that more women are required for the same work than men, but that female labor can be employed at a cost slightly less than that of male clerks. On the whole, therefore, the cost of operating a department remains about the same, as the one increased cost balances the other decreased cost.

NEW YORK COMPANIES DISCONTINUE LAMP SERVICE

United Electric Light & Power and New York Edison Companies Now Go on Merchandising Basis, Charging Higher Prices

On July 1 the New York Edison Company and the United Electric Light & Power Company, supplying New York City and the Bronx, discontinued the practice of furnishing incandescent lamps under the lamp-service contract which includes the furnishing of the first installation and subseqeunt renewals of 50-watt



LAMP ORDER

DATE _____ 191__

THE UNITED ELECTRIC LIGHT & POWER CO.
130 EAST 15TH STREET, NEW YORK

PLEASE DELIVER { ____ CLEAR / ____ FROSTED } 50 WATT STANDARD CENTRAL STATION MAZDA LAMPS

OTHER SIZES _____

AS PER PUBLISHED PRICES, FOR USE ON PREMISES NOTED BELOW.

BEST TIME TO CALL

NAME _____

ADDRESS _____

FORM OF LAMP ORDER FOR CUSTOMERS' USE ADOPTED BY THE NEW YORK EDISON COMPANY

lamps and larger at a monthly charge of ½ cent per kilowatt-hour of energy used. For the use of these lamps subsequent to July 1 the company has decided to make no charge to present lamp-service customers supplied with lamps under the lamp-service contract. From now on the two companies will supply lamps to customers only at the standard list prices, but in supplying these lamps will maintain an adequate delivery service in addition to counter service. Moreover, facilities will be afforded to customers so desiring to purchase their initial equipment of lamps on a deferred-payment plan, full payment to be made in six equal monthly installments to be added to the lighting bill.

There are several reasons for discontinuing the lamp-service arrangement other than excessive cost. First, the service was not altogether satisfactory to the consumer, owing largely it was felt to the inability of a consumer thoroughly to understand the arrangement; second, it was somewhat unfair to the consumers using heating and other appliances to be charged for lamp service on the basis of the entire energy used when

a considerable portion of that energy was used for other than lighting; and third, the addition of 10 per cent at the first of the year to the standard price of lamps was a greatly added burden to the companies, which distributed annually in the neighborhood of $1,000,000 worth of lamps and which would have required considerable advance in the lamp-service contract. Even an advance to 1 cent a kilowatt-hour would not have taken care of all of the additional charges, it is understood, and therefore the service has been discontinued.

The companies have standardized on the 50-watt lamp and by making it easier for the customer to purchase 50-watt lamps than other lamps hope to maintain the average lighting wattage.

Customers have been furnished with return post cards on which they may place their order. One of these is here shown, and as will be noted, by using this card it is much easier to purchase the 50-watt lamp than any other size. In notifying the customers of this change, a circular was sent out which gave also the prices at which lamps would be sold. A 10 per cent discount is allowed to purchasers of standard package quantities.

The company has taken the stand that it will not permit customers to receive discounts on yearly purchase of lamps for deliveries at specified intervals throughout the year. Discounts will be given only on purchases as made. In this way the company relinquishes a considerable amount of business to the local dealer in lamps.

TOO MUCH FAMILIARITY FOUND NOT DESIRABLE

Customers Are Apt to Impose to a Considerable Degree on Manager with Whom They Are Well Acquainted

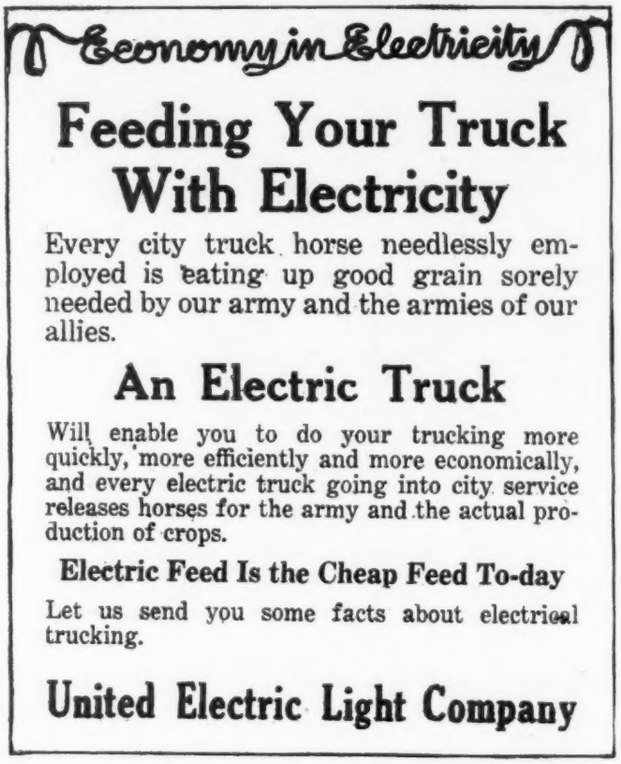
A central-station man who has been acting as local manager for a utility company in the Middle West has had an opportunity to try his hand at the business in several different towns of about 3500 population. When recently asked what mistakes he made in the first of these he handled, he said one of his greatest mistakes had been to permit the public to become too well acquainted with him.

In the first town under his direction he became familiarly known as "Bill" to almost everybody in the city. From one standpoint this was an asset to the company. On the other hand, out of this familiarity grew many requests for expensive gratuitous service. People discovered that they needed to have certain poles moved from in front of their houses or that the street lamp was not in the right location and should be moved up closer to their property. Others, because they thought the manager was a good fellow, began to take more time than was justifiable in the payment of their bills. This went on until the sum total of the impositions which the new manager was forced to endure because of his familiarity with the citizens became formidable. In his subsequent experience in other cities of the same size this manager adopted the policy of keeping on somewhat less familiar terms with his customers, and it is his belief that the change of policy was one that quickly justified itself.

GIVING WAR SLANT TO VEHICLE ADVERTISEMENT

Springfield (Mass.) Lighting Company Shows How Electric Trucking May Be Made to Acquire a Hooverizing Value

The electric truck as a part of the food conservation program seems somewhat far-fetched at first glance, but that is exactly the war-time slant which the United Electric Light Company of Springfield, Mass., is giving to its vehicle publicity, as shown in the reproduction of one of its advertisements in the local papers. The


Economy in Electricity
Feeding Your Truck With Electricity
Every city truck horse needlessly employed is eating up good grain sorely needed by our army and the armies of our allies.
An Electric Truck
Will enable you to do your trucking more quickly, more efficiently and more economically, and every electric truck going into city service releases horses for the army and the actual production of crops.
Electric Feed Is the Cheap Feed To-day
Let us send you some facts about electrical trucking.
United Electric Light Company

A NICE LITTLE VEHICLE "AD" WITH A WAR SLANT

food and fuel saving features of storage-battery transportation lend themselves well at this time to a publicity campaign.

BOYS UNSATISFACTORY AS READERS OF METERS

The Type of Lad Required in This Work Difficult to Obtain Owing to the Higher Wages That Other Employment Offers

The Topeka (Kan.) Edison Company has discontinued its practice of using boys, picked up as temporary employees, for reading meters. The services of the boys in this respect proved to be unsatisfactory and men are taking their places. The men are being employed permanently and do other work when they are not reading meters. A. H. Purdy, general superintendent of the company, expressed the opinion that the company's experience with boys was unsatisfactory because it is becoming increasingly difficult to secure, for temporary work, boys of the type needed, since so many of them are engaged in other occupations that pay more than a utility company can afford to give for this class of work.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Relation of Transformer Design to Load Factor.—S. D. SPRONG.—With the average energy rate and transformer investment the annual losses in a transformer are equivalent to about 6 to 8 per cent of the investment. An extension of secondary mains to what at the time might appear unjustified distances has the advantage first of securing greater diversity factor and thereby increasing the load factor on the transformers, and, second, of reducing energy loss per kilowatt-hour sold. In addition, the investment in secondary mains is largely in copper and a relatively small percentage is in insulation, with the result that there are very small carrying charges, so far as depreciation, obsolescence or repairs are concerned, in addition to the interest on the original investment. Advantages are to be gained by the adoption of a standard-size transformer of, say, 50 kw., and at some later time by the tying together in a general network of the more or less isolated sections supplied by single large-unit transformers as the business in the intervening area develops. The most important result of carrying out such a policy over a five-year period is shown by comparison of the results obtained during the interval. Regulation is easily taken care of where transformers are used in networks, especially with present methods of automatic compensation and regulation. Copper temperatures have been largely limited by the use of cellulose insulation and insulating oil, but with the newer forms of insulation now available, which safely withstand high temperatures without impairment of dielectric value, it may be desirable to consider a reversion to the old air-cooled form, if it is impossible to find any fluid insulator that will remain stable under the higher temperatures. A transformer designed to meet the conditions described would reduce present transformer losses by about 25 per cent.—*Electric Journal*, June, 1918.

Lamps and Lighting

Lamp Renewals.—It is shown that for a period of 4000 to 5000 hours' total use of a new lighting installation the rate of lamp renewals for certain periods may be considerably higher than would be normally expected, and for certain other periods the rate may be lower than the normal rate.—London *Electrical Review*, June 7, 1918.

"Mazda" Lamps for Motion-Picture Projection.—A. R. DENNINGTON.—The principal advantages of this lamp include the steady light emitted, the permanent focus obtainable, better color tone of the picture, no carbon dust to scratch the film and cause wear on the bearings of the machine, and reduced breakage of condensers.—*Electric Journal*, June, 1918.

Generation, Transmission and Distribution

Banking of Distribution Transformers.—P. O. REYNEAU and H. COLE.—Considering economy separately from quality of service, it is necessary to make a complete study of the annual charges against any system to determine the most economical size and arrangement of the units of that system, no matter whether the transformers are banked or unbanked. The following items should be considered: Annual charges on wire, annual charges on transformers and accessories such as lightning arresters, fuses, etc., core losses, transformer and secondary copper losses, and annual operating, maintenance, inspection and testing charges. The study would show the combination of wire and transformers which would be best for a given density of load considering the load to be uniformly distributed along the secondary mains. If the best possible service is required, banking will undoubtedly be preferable as it is possible by this method to insure practically perfect service so far as the secondary distribution system is concerned, because trouble on a well-constructed secondary main is very rare.—*Electrical Review*, Chicago, June 8, 1918.

Scope and Application of the National Electric Safety Code.—The need for the code is explained and the manner of application by engineers and inspectors is briefly explained. A short summary is given of the provisions of each of the four principal parts of the code.—*Circular No. 72, Bureau of Standards*, June 17, 1918.

Transmission-Line Practice, Part VI.—LIEUT. E. T. DRIVER and E. V. PANNELL.—Brief reviews of the construction of various transmission systems, including the Mississippi River Power Company, Cedar Rapids line, Tennessee Power Company, Pacific Light & Power Corporation, Tata Hydroelectric Company (India), Victoria Falls & Transvaal Power Company (South Africa), Lake Coleridge development (Southern Alps), and the Inawashiro Hydroelectric Company (Japan).—*Electrical News*, June 1, 1918.

Installations, Systems and Appliances

Standardization of Frequency.—H E. WARREN.—The benefits which will accrue from the standardization of frequency and from maintaining it accurately at the selected value are emphasized. A method of doing the latter in what the author considers a more effective manner than has been done is explained.—*Journal of Electricity*, June 15, 1918.

Feeder Voltage Regulators for Outdoor Operation.—I. C. MINICK.—Details of construction which have been employed to adapt feeder regulators for outdoor service are outlined. One feature is the attaching of the completely assembled regulator with all its accessories to the top cover so that the parts may be lifted as a

unit from the tank without disturbing the housing. This feature is of considerable importance from an operating standpoint as complete inspection or repairs to any part of the regulator may be made without drawing off the insulating oil and without removing the tank from its location. A felt gasket and flange on the housing form a moisture-proof joint when the top cover is bolted down, and further protection from inclement weather is afforded by the overhang formed by the lower edge of the housing. The leads are brought out of the tank through porcelain bushings babbitted in the flange.—*Electric Journal*, June, 1918.

Tubular Earths for Lightning Conductors.—KILLINGWORTH HEDGES.—There are several objections to the use of the plate form of earths, even when they are buried to a suitable depth in moist ground. One is that the soil may dry away, leaving the plate only in partial contact, so that the resistance increases sometimes to such an extent as to insulate the ground connection. On the other hand, the tubular earth, with its point driven firmly into the ground, does not lose efficiency by changes in the soil which are noticeable in the proximity of new buildings, owing to drainage, and it has a constant resistance. Another important factor is its lower first cost.—London *Electrical Review*, May, 3, 1918.

Turbo-Electric Ship.—Description of the propelling apparatus of the turbo-electric ship Wulsty Castle. Two sets of Ljungstrom three-phase turbo-alternators are used which ordinarily operate in parallel and drive two induction motors connected with the propellers through speed-reduction gears. The stators of the generators and motors are wound with solid bar in each slot, the insulation consisting of seamless mica tubing and the end connections of massive flat strip. Ventilation is assured by blades on the rotors. The end windings of the generators are supported by especially rigid brackets to prevent damage in case of short circuits. Each rotor consists of a solid steel forging in which slots are milled to receive the windings. The rotors of the motors are of the cylindrical barrel type. Gunmetal slip rings are used and the brushes are equipped with lifting and short-circuiting gear to eliminate unnecessary loss and wear.—London *Engineer*, May 17, 1918.

Electrophysics and Magnetism

Distribution of Electric Field in Vacuum Tube.—TOSHIO TAKAMINE and USABURO YOSHIDA.—The distribution of the electric field in the Crookes dark space of a vacuum tube of very small diameter is determined by Lo Surdo's method. The gas with which the vacuum tubes were filled was in most cases hydrogen, but in a few cases it was a mixture of helium and hydrogen. The glow was never uniform in the dark space, but was mainly concentrated in the axial portion of the tube, except in the space just in front of the cathode, where a glow of nearly uniform intensity occupied the whole portion of the tube. In the course of investigations on the effect of the electric field on the spectrum lines of hydrogen and helium it was found in practically every case that a parabolic formula expressed fairly well the distribution of the electric field in the Crookes dark space.—*Memoirs of the College of Science*, Kyoto Imperial University, October, 1917.

Effect of Electric Discharge on Photographic Plate.—USABURO YOSHIDA.—The author concludes that the light which impresses a discharge figure on a sensitive film is of the same nature as that of a spark so far as the Clayden effect is concerned. The article is illustrated by several remarkable photographs of phenomena observed.—*Memoirs of the College of Science*, Kyoto Imperial University, October, 1917.

Photoelectric Sensitivity of Bismuthinite and Other Substances.—W. W. COBLENTZ.—An increase in electrical conductivity was observed in crystals of selenium, stibnite, boulangerite, jamesonite, bismuthinite, cylindrite, molybdenite and silver sulphide when exposed to light. In the case of bismuthinite the change in conductivity is confined to quite narrow regions along the length of the crystal, occurring usually at the intergrowth or line of contact of two bundles of acicular crystals. In the case of molybdenite the change in conductivity is to some extent a function of the thickness (heat capacity) of the lamina. Further experiments are in progress to determine to what extent and for what wave lengths this resistance change is a true photoelectric phenomenon. Light was also observed to change the resistance of thin blackened strips of platinum or gold. Of the various substances examined, none was found which is so sensitive to light as are the selenium cell and the potassium photoelectric cell.—*Scientific Paper, Bureau of Standards*, June 14, 1918 (No. 322).

Miscellaneous

Industrial Electric Heating.—ARTHUR F. ALLSOP.—The advantages of a heating load to central stations are discussed in the following order: What electric heat can be used for; typical examples of advantageous uses; healthfulness and safety of electric heat; electric heat from the central-station viewpoint and the field of industrial heating; the advantages of industrial electric heat. A table of uses and users of electric industrial heating devices is included.—*Electrical Review*, Chicago, June 15, 1918.

Data Necessary for Rate Determination.—BERT H. PECK.—In establishing rates for utility service a regulating body must give consideration to practically the entire scope of the utility operations, which may be classified as follows: Value of the property; operation expense; character of the enterprise; local conditions affecting the operation and development of new business; conditions which determine the accruing depreciation, and effect of proposed forms of rates. —*Journal of Western Society of Engineers*, Chicago, January, 1918.

Pacific Coast Engineering Problems.—The discussion at the recent Del Monte conventions brought out considerable information that is valuable in solving electrical problems of the West in the present crisis. The subjects dealt with are: Possible water-power development in California; shortage of fuel oil; water-power conservation; transmission and distribution losses; steam-power-plant economies; power-plant economies in the Northwest; hydroelectric economy; transmission and distribution economies; iron and steel conductors; standardization of pin-type insulators; substitute for cedar poles; report on special pine poles, and insulator deterioration.—*Journal of Electricity*, San Francisco, June 1, 1918.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF

Cornell University, Ithaca, N. Y.

Apparatus Available

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Technical Theory and Practice" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

MEASURING INSTRUMENTS, ELECTRODYNAMOMETER.

A double-element astatic deflecting electrodynamometer has been designed and constructed at the Electrical Testing Laboratories recently. It can be used as a voltmeter, an ammeter or a polyphase wattmeter, according to conditions. It has also been found very useful as a differential voltmeter as well as for comparing alternating-current and direct-current voltages for purposes of standardization. The fixed coils, which are circular, are attached to vertical slabs of alberene stone. The coils on the front slab are connected into the circuit through four studs so that the front can be removed at any time without detaching any wires, and the moving system is completely accessible. Each element of the moving system is composed of two semi-elliptical coils which are tied and cemented with sealing wax to a thin glass tube. This tube also carries the mirror. Current is carried to the coils by four light silver strips (similar to oscillograph strips). Two of these extend upward from the top pair of coils and the other two downward from the bottom pair. These strips are not subjected to tension and contribute very little to the controlling force of the apparatus. The suspension is a thin steel strip and is fastened to a small slab which is attached rigidly to the back of the instrument and constitutes its top. Suspended from the bottom of the tube is a vane which moves in a small glass vessel filled with oil and provides damping which can be adjusted by changing the character of the oil used. The base is of alberene stone, which also constitutes the back of the instrument. The front is composed of a similar slab supported by four long studs of brass fastened into the back. The sides are of glass fitting in slots in the stone slabs.—*Clayton H. Sharp, Electrical Testing Laboratories, New York City.*

Suggestions for Research

CABLES, TEMPERATURE RISE.

An insulation by the use of which underground cables may be operated at higher temperatures than at present is greatly needed. The insulation need not be suitable for any but low-voltage circuits, up to 750 volts. Circular segmental porcelain tablets strung on a cord, or a tape made of bakelite or similar substance, might be used. Mica in the thickness that would be necessary would probably be too expensive to apply, and asbestos would be too low in dielectric strength.—*Selby Haar, New York City.*

CONDUCTIVITY, THERMAL.

There is need for data in convenient form for the flow of heat from one liquid to another through a separating wall, as in the cooling of transformer oil by water. A search through the literature shows serious disagreement, lack of essential constant, typographical errors, indefinite and confusing terms, etc. The theory is necessarily very complicated, as the controlling factor is the surface resistance, hence also the surface velocities of the liquids. Experimental data are desired covering the ranges frequently occurring in practice, but accompanied by all the necessary facts, as a single missing factor may make the data absolutely useless.—*Carl Hering, Philadelphia.*

CONDUCTORS, HEATING OF.

There is a very great and growing use of low-voltage direct current in large volume for electrolytic and electric furnace installations. These require the use of rotary converters and hence involve heavy alternating currents at low voltages. The inductive drop, the energy losses, the operating temperature and the unequal division of current between parallel feeder conductors are limiting factors in the design. There is a woeful lack of information on which to base reliable calculations for any actual installation, especially in the matter of operating temperature. Data are required for heavy currents, say 3000 amp. to 8000 amp. direct current and 5000 amp. to 15,000 amp. actuating current. The temperature rise of bare copper conductors should be determined as a function of their dimensions, shape, arrangement, condition of surface, air drafts, mutual induction in the case of polyphase currents, etc. *P. H. Thomas, New York City.*

CORE LOSSES IN MOTORS.

The core loss in an alternating-current motor is much greater than the amount calculated by the transformer method, on account of the irregularities in flux densities and combination of field and armature. It has been the writer's experience that the so-called added iron loss, or the amount of iron loss over and above that which can be accounted for by the transformer losses, varies from 25 per cent to 250 per cent or 300 per cent more than transformer loss. In predetermining the characteristics and losses of motors all of the factors can be calculated with a fair degree of accuracy except the iron losses. Iron losses, on account of wide variations, may change the results appreciably from what is expected. Therefore a systematic investigation, both theoretical and experimental, of these "added losses" in revolving electrical machinery is a splendid subject for research.—*J. L. Hamilton, St. Louis, Mo.*

DIELECTRIC LOSS, EFFECT OF LIGHT ON.

It would be of interest to measure the dielectric energy loss of a sulphur condenser both in darkness and when exposed to the light. The condenser plates could be made with small holes in them to permit the action of the light. The measurements could be made with the series inductance bridge described in the ELECTRICAL WORLD for March 9, 1918, and would give some interesting information on the nature of dielectrics, the photo-electric effect and the actino-dielectric effect.—*C. A. Butman, Rockport, Mass.*

INDUCTION MACHINES.

Frequently the number of the conductors of the rotor of a polyphase induction motor is not divisible by the number of poles and phases. It would be of value to determine by experiment and by theory the exact field shapes which are produced by such windings. There may be two fields produced, one having as many poles as the armature has poles and the other having a number of poles different from the number of poles in the armature.—*H. Weichsel, St. Louis, Mo.*

LIGHTNING ARRESTERS, HIGH-VOLTAGE RESISTANCES IN GROUND CONNECTIONS.

To prevent an excessive dynamic current discharge over horn-gap lightning arresters on 33,000-volt transmission systems it has been customary to insert in the ground connections of such arresters high-resistance rods of some material such as carbon, carborundum, kopat or concrete. The last material being somewhat less expensive, attempts have been made to construct resistances which would have sufficient mechanical strength and sufficient electrical resistance to limit the current to a desired value. Experiments carried out on an actual operating line seem to indicate that such concrete resistances are both practical and effective. It seems that the richer the concrete the greater the electrical resistance. It would be of considerable value to have complete information as to the relations existing between the concrete mixture and the electrical resistance, and some means should be found so to waterproof concrete columns that the resistance would not change in value because of differences in humidity or weather conditions. Great variations in the resistance have been found due to this cause. —*V. L. Hollister, University of Nebraska, Lincoln.*

DIELECTRICS, STUDY OF DETERIORATION.

Two methods for testing insulation in service are in use — (a) resistance measurement or megger test, (b) overvoltage test. Both tests are admittedly unsatisfactory, because the value of the resistance alone gives but very meager information about the state of the material under stress, and the overvoltage test in many cases shortens the life of the insulation. It would be of great benefit if some one would undertake a thorough and accurate study of the physical and chemical changes in various kinds of partly impaired or overstressed insulation. As a result of such a study, it may be possible to devise practical and reliable methods for testing insulation without subjecting it to abnormal stresses.—*Editorial Suggestion.*

MACHINERY, ELECTRICAL NOISES IN.

It would be very desirable to investigate in detail the causes of noises in electric motors, special attention being paid to the noises produced by the electric and magnetic conditions of the machine. Furthermore, a detailed investigation would be valuable regarding the most suitable foundation for motors, to prevent the noise caused by the machine from traveling through the foundation into the building.—*H. Weichsel, St. Louis, Mo.*

MACHINERY, ELECTRICAL, VENTILATION OF.

No formulas or investigations seem to be in existence which could be used for predetermining the amount of air which blowers with radial plates are capable of producing.—*H. Weichsel, St. Louis, Mo.*

MANGANIN.

Relation between the temperature coefficient and the composition of manganin.—*M. E. Leeds, Philadelphia.*

PHOTOELECTRIC SENSITIVENESS.

This is a field of endeavor which has received a good deal of attention from physicists, though it is apparently not very well systematized. It is of considerable importance at the present time because of its commercial applications (self-lighting buoys, objective photometry, telelectric transmission of pictures, etc.). The photoelectric sensitiveness of a material is the variation of its electrical resistance as conductor when subjected to different intensities of illumination. Selenium has been largely utilized for this purpose, but is unsatisfactory because of its very poor conductivity and unreliability. Many other materials are sensitive to light, but apparently no thorough investigation has been made of this subject.—*Chester I. Hall, Fort Wayne, Ind.*

PYROMETERS.

Optical pyrometer applied to various industries. Emissivities of materials for determining corrections to true temperature.—*M. E. Leeds, Philadelphia.*

SKIN EFFECT IN STRANDED IRON CONDUCTORS.

Some power transmission companies use stranded iron conductors for high-tension lines on which the load is rather light. We have used a three-wire strand made of No. 9 B.B. galvanized iron telephone wires and a seven-wire strand made of No. 9 E.B.B. telephone wires. For a line in Chile conductors will be used of ⅜-in. Siemens-Martin steel strand. The Bureau of Standards has published some data and theory on skin effect and inductance of solid iron wires *(Scientific Papers*, No. 252), but no information seems to be available on stranded iron conductors. This subject deserves further investigation to enable the designer to predict the performance of a proposed line more closely.—*H. H. Cochrane, Montana Power Company, Butte, Mont.*

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

WORK FOR COAL SAVING IN MASSACHUSETTS PLANTS

Advisory Engineering Committee to New England Division of United States Fuel Administration Taking Active Steps

Organized and detailed methods of saving coal set forth in non-technical language are embodied in a bulletin just issued by the advisory engineering committee to the United States Fuel Administration, New England division, for service among manufacturers, central stations, operating engineers, firemen and other coal users.

The bulletin was prepared under the direction of President Ira N. Hollis, Worcester (Mass.) Polytechnic Institute; Charles T. Main, Boston, president American Society of Mechanical Engineers; W. G. Starkweather, Boston; George P. Gilmore, Fall River, Mass.; Arthur T. Safford, Lowell, Mass.; Joseph A. Skinner, Holyoke, Mass., and Thomas Hawley, Boston. Arthur E. Norton is secretary of the committee and James J. Storrow is New England Fuel Administrator.

The prominent engineers composing the committee were selected some weeks ago to co-operate with Mr. Storrow in conserving fuel in face of an existing shortage in New England of at least 6,000,000 tons, and are ready to give information and general advice on this subject as a war measure. The committee has already been instrumental in organizing in many industrial plants fuel and power committees whose duties are to see that fuel is burned economically and that steam and power are not wasted. An organization chart showing the duties of representative industrial plant officials and members of such a committee has been prepared.

"Coal economy or no coal at all" is the situation which many New England industrial plants face. In the coming year there will be (in fact, now is) a shortage of at least 6,000,000 tons of steam coal in that section of the country, and the entire region will suffer unless measures are taken to reduce the consumption. Massachusetts is endeavoring to do her share, not only to get through the winter without closing down manufacturing plants, most of which are doing war work, but also to give the army and navy the fullest possible support in the war.

The advisory committee is working in co-operation with the local fuel committees of the Fuel Administration, and through them the manufacturers and operating men, to outline plans for reducing the consumption of coal. Emphasis is being laid upon the fact that waste is not confined to boiler and engine room equipment, but that the loss or misuse of steam within a mill or factory is just as fatal as the waste of coal in steam production, and that the loss of power in shafting or motors and the waste due to too many lamps are exactly as fatal to economy.

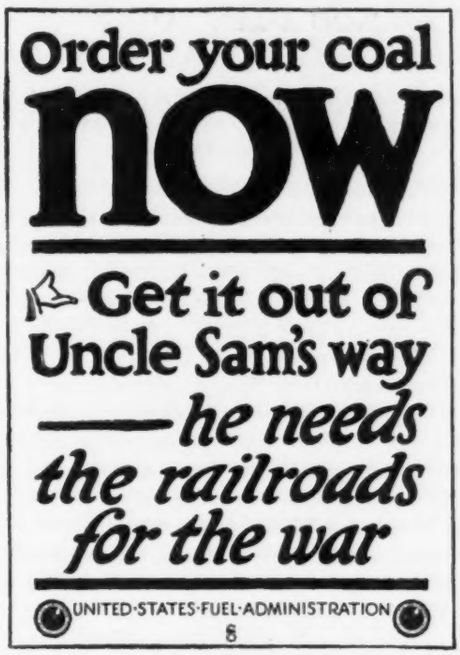
Consequently savings of coal can be effected only by taking up a manufacturing establishment as a whole, beginning with the unloading of coal from cars or barges and ending with the shipping of the manufactured product. It is absolutely necessary, the committee feels, that every manufacturer in the state should willingly take measures to eliminate waste of all kinds.

Something may be accomplished by cutting considerable supplies of wood, the committee states, but it must be taken up at once if the wood is to be fit for use. Green wood cut next winter is not nearly so good as partly dried wood cut this summer. It is urged that every fuel committee take up the cutting of wood within easy reach of its district. There will probably be no possibility of hauling much cord wood by rail. Short distances are the prime consideration. Oil fuel offers very little relief at this time, as the demand is heavy for marine purposes and the supply doubtful for companies not protected by long-term contracts.

Many textile mills and shops on Massachusetts rivers use water power when it is available. In some cases this power furnishes but a small fraction of the total power developed and for this reason has not had much attention. Most of these developments do not use nearly all the high flows of spring, early summer and fall. With present prices of coal, increased development of 25 per cent or more will prove good business and save coal. A hundred horsepower in water means a saving of at least 1.5 tons in a ten-hour day.

In addition, the revamping of old transmissions and change to vertical hydroelectric units will increase the power at the machines anywhere from 30 to 100 per cent. The committee announces that it will be glad to furnish general advice and, in specific cases, a list of hydraulic engineers, waterwheel companies and efficient waterwheel settings which may be useful for revamping waterwheel equipment.

To produce as much as possible in whatever work we are engaged and economize consistently in the use of materials of every kind is now the patriotic duty of all. The Westinghouse Electric & Manufacturing Company, with about 85 per cent of its business directly or indirectly for the government, must operate its plants with the greatest efficiency in order to produce the largest output with the smallest possible use of labor and material, and thus give economically the service required. Conservation, care and diligence should be practiced as never before. Every officer and other employee in doing his best for the company is doing his best for the country and for himself.—*E. M. Herr.*



LARGE COAL SAVING MADE IN PITTSBURGH INDUSTRIAL PLANTS

Inspection of These Plants as Reported to United States Fuel Administration Yields Immediate Results

Thomas R. Brown, administrative engineer of the United States Fuel Administration for the Pittsburgh district, in a report received in Washington, says that through the inspection of industrial steam plants, which was begun there only a few weeks ago, a saving of 81,000 tons of coal per year has been effected in the Pittsburgh district. This saving represents a little more than one week of actual inspection under the general program announced by the Fuel Administration.

In five manufacturing plants using coal for production of power an annual saving of 53,942 tons of coal has been made by improved methods of firing, stopping leaks around boiler settings and other factors which make for economy in the general conditions of boiler plant operation.

Mr. Brown's report discloses that one great plant operated in his district was rated at only 59 per cent of efficiency in the use of coal. If this ratio, or anything like it, should hold good for the industrial plants in other districts where the efficiency is recognized as not being nearly so high as in the Pittsburgh district, then the Fuel Administration feels assured that it will be an easy matter to save from 25,000,000 tons to 30,000,000 tons in the 250,000 industrial plants in the United States without in any way reducing the quantity or quality of the output. However, in fairness to the Pittsburgh district, it may be said that the report shows an average efficiency of almost 80 per cent.

Announcement of the appointment of these state administrative engineers has been made: Hans J. Meyer, consulting engineer, Minneapolis, for Minnesota; Henry Adams, consulting engineer, Baltimore, for Maryland; Horace S. Hunt, consulting engineer, Jackson, for Michigan.

Eugene C. Eppley, of Sioux City, Iowa, president of the Hotel Men's Mutual Benefit Association, has been appointed head of the hotel section of the Conservation Bureau, United States Fuel Administration. Regulations for the conservation of heat, light and power in hotels, in keeping with plans laid down at a recent conference between the Hotel Men's War Service Committee and the Conservation Bureau, are under consideration.

SECTION OFFICERS OF THE ASSOCIATED MANUFACTURERS

Electrical Supply Makers in Various Lines Elect Section Officials—International Trade Committee Tariff Meeting Announced

Sections of the Associated Manufacturers of Electrical Supplies have elected officers recently as follows:

Lamp Receptacle and Socket Section—H. R. Sargent, General Electric Company, chairman; H. J. Morey, Pass & Seymour, Inc., secretary; George E. Maguire, E. H. Freeman Electric Company, treasurer.

Industrial and Street-Lighting Fixture Section—C. O. Baker, Wheeler Reflector Company, chairman; C. E. Stephens, Westinghouse Electric & Manufacturing Company, secretary; W. F. Minor, Ivanhoe Regent Works of General Electric Company, treasurer.

Snap Switch Section—E. R. Grier, Arrow Electric Company, chairman; F. E. Watts, Hart Manufacturing Company, secretary; F. P. Gates, Arrow Electric Company, treasurer.

Knife Switch Section—J. H. Trumbull, Trumbull Electric Manufacturing Company, chairman; W. T. Pringle, Pringle Electric Manufacturing Company, treasurer; T. A. McDowell, Westinghouse Electric & Manufacturing Company, secretary.

Attachment Plug Section—C. A. Bates, Bryant Electric Company, chairman; F. T. Wheeler, Trumbull Electric Manufacturing Company, secretary; A. H. Fleet, Cutler-Hammer Manufacturing Company, treasurer.

Outlet Box Section—F. W. Hall, Sprague Electric Works of General Electric Company, chairman; H. G. Knoderer, National Metal Molding Company, secretary; H. D. Betts, Thomas & Betts Company, treasurer.

Fuse Section—Robert C. Buell, Johns-Pratt Company, chairman; Clarence A. Bates, Bryant Electric Company, secretary; F. V. Burton, Bryant Electric Company, treasurer.

Panelboard and Switchboard Section—Charles E. Wilson, Sprague Electric Works of General Electric Company, chairman; F. T. Wheeler, Trumbull Electric Manufacturing Company, secretary; W. T. Pringle, Pringle Electric Manufacturing Company, treasurer.

The Heating Appliance Section, the preliminary organization of which was reported in the ELECTRICAL WORLD of June 1, 1918, has effected permanent organization with the following officers: F. D. Goode, Cutler-Hammer Manufacturing Company, chairman; Harry S. Mirrieless, Manning, Bowman & Company, secretary; B. S. Manuel, Westinghouse Electric & Manufacturing Company, treasurer.

The international trade committee of the Associated Manufacturers of Electrical Supplies will meet at 2 p.m. on July 24 at the association offices, New York. William Burgess, adviser of the committee in tariff matters, will be present. It is proposed to discuss the detail work which must be done in each section under the advice and direction of Mr. Burgess in making a careful analysis of the various lines of products in the industry so that definite recommendations may be decided upon by each branch of the industry for submission to the United States Tariff Commission.

CONTRACTORS' MEETING IS HELD AT CLEVELAND

Eighteenth Annual Convention of the National Association Is the First Meeting with New Form of Organization

The eighteenth annual convention of the National Association of Electrical Contractors and Dealers, the first meeting of the body under the new form of organization, opened at Cleveland on Wednesday of this week with an attendance of nearly 300. The convention followed a two-day meeting of the executive committee for the transaction of routine association business as provided by the new plan.

In welcoming the convention to Cleveland, A. L. Oppenheimer, president of the local association, urged the contractors to study ways to make their efforts useful toward winning the war.

W. Creighton Peet, national chairman, drew attention to the changes effected in the method of conducting the association, pointing out that the association has thrown open all its convention and legislative committee sessions in order that the electrical industry and the public may better know its aim and methods.

William Ganson Rose of Cleveland spoke on the subject of enthusiasm in business and its power to overcome obstacles. "Enthusiasm," he said "is the electric headlight on the train of progress."

Earnest McCleary, Detroit, urged confidence in association as well as national affairs.

G. M. Wheeler, New York, presented William L. Goodwin of New York with a Tiffany engrossed gold and leather testimonial on behalf of the electrical contractor-dealer associations of Greater New York, and by rising vote Mr. Goodwin was made an honorary member of the national association.

At the afternoon session E. E. Van Cleef, Chicago, presented L. K. Comstock's paper on "A Proposed Scientific System of Wage Adjustment." This paper, advocating automatic adjustment of wages to meet advancing "cost of living," covered the same ground as Mr. Comstock's articles in the ELECTRICAL WORLD for March 16 and March 23 last.

E. D. Sickles presented a paper on "Unit Labor Costs," by F. W. Lord, New York, outlining a system of reports on productive and non-productive labor costs, and discussing the best practice in estimating methods.

John R. Smith of the Electrical Estimators' Association, Chicago, presented a report on labor data based on the actual accounting experience of a group of important Chicago contractors. The report contained valuable data, with schemes for checking estimates.

An address by William L. Goodwin on "The Goodwin Plan," citing twenty-one fundamental planks of the "Pacific Coast merchandising platform," was the feature of Thursday morning, and at noon the convention adjourned to Nela Park. At the afternoon session Sullivan W. Jones spoke on "The Electrical Contractor's Duties to the Nation," and Franz Nielsen, association attorney, discussed differentials from a legal standpoint. Dwight D. Miller, Society for Electrical Development, Inc., read a paper on "The Application of Electricity to Industrial Plants."

Merchandising and farm-lighting topics occupied the sessions of the closing day, Friday.

WAR FINANCE LOAN TO COMMONWEALTH COMPANY

Government Corporation to Advance $2,400,000 Toward Providing for $8,047,000 Matured 5 per Cent Bonds

The War Finance Corporation has agreed to advance $2,400,000 to the Commonwealth Power, Railway & Light Company toward retirement of $8,047,000 convertible 5 per cent bonds on condition that the company obtain an extension of the balance of the securities. The bonds were due on May 1, 1918. Anton G. Hodenpyl, president of the company, offers holders of the bonds two plans for completing the arrangement.

Under one plan owners may receive a new $1,000 five-year 7 per cent secured convertible gold bond and $25 in cash, representing 2½ per cent discount on the new bond, for each thousand-dollar old bond. The other plan calls for a new $700 five-year 7 per cent convertible gold bond, together with $17.50, representing a discount of 2½ per cent on the $700 bond, and $300 in cash for each $1,000 of bonds matured.

PRIMARY PURPOSE OF THE WAR FINANCE CORPORATION

Treasury Department in Formal Statement Says that War Finance Corporation Is Designed Primarily to Extend Credit Through Banks

The Treasury Department authorizes the following:

The War Finance Corporation was designed primarily to extend credit through the banks of the country, and not directly to borrowers, to industries which are necessary or contributory to winning the war. Only in exceptional cases, in rare instances, will loans be made directly to industries.

War conditions have brought to bear a very heavy burden on the banks of the country. They are called upon to assist largely in financing the government, as well as to meet the increased legitimate financial demands of the industries of the country. The War Finance Corporation was created to enable them to continue to furnish essential credits for war industries and enterprises necessary or contributory to the prosecution of the war.

The corporation, therefore, is an instrumentality to which the banks can resort to obtain assistance to finance war industries and is not intended to be a direct lender to corporations or individuals.

GEORGE A. HOADLEY IS MADE I. E. S. PRESIDENT

Acting Secretary of the Franklin Institute Is Elected to Head Illuminating Engineering Society in New Year

George A. Hoadley, acting secretary of the Franklin Institute, Philadelphia, has been elected president of the Illuminating Engineering Society for the new year, which begins on Oct. 1, 1918. He was formerly professor of physics and electrical engineering at Swarthmore College.

Election of the following officers is also announced: Vice-presidents, Otis L. Johnson, H. K. Morrison and H. A. Hornor; general secretary, Clarence L. Law; treasurer, L. B. Marks; directors, John C. D. Clark, Evan J. Edwards and James J. Kirk.

POST-WAR PROBLEMS OF THE ELECTROCHEMICAL INDUSTRY

Fall Meeting of American Electrochemical Society at Princeton, Sept. 29 to Oct. 1, Will Take up Reconstruction Matters

The American Electrochemical Society will hold its fall meeting at Princeton, N. J., Sept. 29 to Oct. 1 and is planning to devote one session to a consideration of the reconstruction and post-war problems of the industry. The status of all our industries after the war is a most important question, and it is felt that it deserves careful study at this time. This is especially true of many electrochemical industries which the demands of the war have stimulated to a point of expansion far beyond the requirements of peace.

Many of these industries, such as the chlorine and alkali industry, the ferro-alloy industry, the manufacture of electric steel and the carbide industry, have undergone an enormous expansion.

"We shall have the problem of the disposition of government-owned plants," says the announcement of the society. "We must develop new uses in the arts of peace for the products of our war plants. Almost all of these questions of reconstruction and readjustment are pressing in view of the world-wide competition which will follow a declaration of peace. Other subjects are the future of air nitrates, the electric power situation and research after the war in its varied university, governmental and industrial phases.

"A topic of far-reaching importance is the future relations of technical men to the affairs of government. Can the very important work of some of our technical boards be continued after the war and be made to function with the administrative and legislative branches of the government?"

DISCUSS THE SHORTAGE OF STUDENTS AND INSTRUCTORS

W. L. Abbott Describes Experiences of the Commonwealth Edison Company Before Society for Promotion of Engineering Education

How to meet the increasing demands for engineers to carry on the war and industry now and also to provide for the reconstruction period were the impelling questions back of much of the discussion at the convention of the Society for Promotion of Engineering Education held June 26 to 29 at Evanston, Ill. Prof. C. R. Mann, who outlined the forthcoming report of the joint committee on engineering education and also the latest decisions of the government with reference to students' training camps, was the center of debate nearly the whole of one day. During an evening session members of the Western Society of Engineers and sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers added their views, a joint meeting being held for the purpose of getting the views of the practicing engineer.

W. L. Abbott, chief engineer Commonwealth Edison Company, detailed methods by which the public service companies recruited engineers. Formerly a young graduate was put to work at $2 per day with the gang. At the end of the year the man might still stick but not from any effort on the part of the company. His trustworthiness and eagerness to take responsibility were about the only things that would bring him to the attention of his employer. That day passed some years ago, as recruits failed to materialize. This reluctance on the part of men to seek work was progressive from East to West, and finally the Central Station Institute was founded, in which thirty to fifty were trained for a year. A charge of $400 a year was made, and the men were paid $40 per month for the part time spent in the different departments. In four years there were eighty-five graduates, one-half of whom stayed with the company until the war began, when 80 per cent left, practically terminating the experiment.

Now the plan is to give the men a large part of the preliminary work in five vacation periods while at school. Only one-half day a week is given to classroom study. The pay is $60 to $90 per month. As before, the men are shifted often from one department to another. The latter is a serious drawback because department heads are not enthusiastic about training a green man charged to them only to have the new man transferred when he is ready to do productive work. Taking the men during vacation works so well that Mr. Abbott is of the opinion that it would be desirable to put them on during freshman year and possibly take them from high school. Just at present the government is combing out the lists, and he believes that this is a mistake, for if the men had completed their full course there would now be thousands of graduates well equipped to handle the necessary war industries.

In the address of the president, Milo S. Ketchum, read by John F. Hayford, on "Essentials in Engineering Education," he pointed out that the most critical problem in engineering education to-day is to obtain a sufficient number of competent teachers. No greater task, in his opinion, can be undertaken by the society, than to improve the conditions and increase the emoluments of engineering teachers.

"Help the Red Cross"

In this Red Cross sign, displayed in New York, the letters in "Help the Red Cross" are 7 ft. (2.1 m.) high. The eagle is 26 ft. (7.9 m.) high and the structure itself is 44 ft. high by 72¾ ft. (13.4 m. by 22.1 m.). The use of this sign was donated to the Red Cross by the Anheuser-Busch Company. The sign was designed and built by the O. J. Gude Company, New York.

OHIO'S WAR CONVENTION TALKS OF TIMELY BUSINESS

Constructive Committee Activities—War-Time Operation Discussed at Round-Table Meeting—I. L. Oppenheimer Elected President

While the registered attendance at the twenty-fourth annual convention of the Ohio Electric Light Association at Cedar Point, July 10, 11 and 12, was only about 225, as against the usual 400 or 500, the sessions were better attended than in normal years. This was taken as an indication that those who attended were there for business and that the executive committee had acted wisely in deciding to hold a convention instead of postponing it as was done last year. No entertainment was provided for delegates. This plan, according to Secretary D. L. Gaskill, appeared so satisfactory that it will doubtless be followed each year, for the duration of the war at least.

War-Time Operation

Discussion at the round-table meeting on war-time operation was timely. J. C. Martin of Columbus spoke on the legal status of rate contracts in Ohio. He said that for several years Ohio utility men had been endeavoring to assist in any work that would tend to clothe the Public Utilities Commission with more power. Just now, however, when the utilities more than ever before need the help of the commission in getting relief from rates which are too low, it appears that the Supreme Court of Ohio has taken from the commission some of its power. According to Mr. Martin's interpretation of a recent Ohio Supreme Court ruling, public utility franchises granted prior to the passage of the public utility act were to be considered as valid contracts between the company and the municipality and not subject to the jurisdiction of the commission. This, the speaker pointed out, is a complete reversal of established trend and will place the utility companies back in the hands of municipal authorities, where they were years ago. He suggested as remedial measures an appeal to the Supreme Court of the United States, to get if possible a reversal of the opinion of the Supreme Court of Ohio, or an appeal to the Legislature to enact an indeterminate franchise law under which all old franchises could be surrendered.

F. H. Hooper of Van Wert, commenting on Mr. Martin's interpretation of the court ruling, expressed the opinion that the outlook was not so dark. He said that the commission had always held it had no jurisdiction over lighting rates fixed by city ordinance and suggested in such cases the direct help of municipal authorities. On some power contracts he said he believed the ruling would be beneficial, for many companies have made power contracts at prices less than published schedules. This ruling will afford an opportunity to increase these rates to those in published schedules if the necessity of increasing them exists.

D. L. Gaskill of Greenville spoke on the non-essential demands which those in authority make of public utilities. There has been no thought of conserving effort by asking fewer or less voluminous reports from public utilities or asking less costly public improvements. The reports to the Public Utilities Commission are not so bad, but some others, such as those required by the tax commission and the government, are burdensome. Orders for municipal improvements, such as repainting poles, which are not at all necessary and which require money, are still being issued. Mr. Gaskill expressed the opinion that there should be a concerted effort to correct this situation and that attention should also be turned to getting other manufacturing and mercantile businesses taxed as going concerns just as public utilities are now taxed.

At this session Dr. M. G. Lloyd spoke on the "Work and Scope of the Bureau of Standards." He urged central-station operators to send in constructive criticism of the National Electrical Safety Code because it is in process of revision for final publication and probable adoption by state and municipal authorities.

Reports of all standing committees were presented at the meeting. The fact that interest in the association has not lagged was attributed largely to the work of standing committees.

The illumination committee, of which Prof. F. C. Caldwell of Columbus is chairman, was first to report. The illness of Professor Caldwell has prevented accomplishment of some work contemplated. In the coming year, with open committee conferences scheduled and with an elementary textbook under way which is intended to give the public much needed instruction in the elementary principles of good lighting, it is expected much progress will be made.

In discussion of this report the question arose as to what stand a company should take in regard to street-lighting revenue it would lose by curtailment of public lighting service. E. H. Beil of Youngstown said that in the former period of lightless nights the city expected to be granted the regular rate established for outages in the street-lighting contract. The representatives of the company pointed out, however, that its investment was active whether the city was using it or not. On this basis the city agreed to pay the cost of operation even during lightless night outages. G. E. Miller of Cleveland suggested that where only the cutting down of intensity was essential it would be possible in some cases to reduce the size of lamps used and then to make reduction in price comparable with the difference in the amount of energy used.

Modern Central-Station Methods

The work of the station operating committee, of which Henry B. Dates of Cleveland is chairman, consisted during the last year of eleven papers, discussions and visits to the modern power stations. The committee had held four conferences. The following topics were covered:

1. The discussion of the fuel question, not only from the standpoint of supply and cost, but, of prime importance to the operating man, the questions of quality and efficient use of the fuel.

2. Power-plant losses and their prevention, this subject including the types and applications of power-plant efficiency meters.

3. The organization of labor in power-house work and educational work among power-plant operators.

4. A first-hand study in the most modern power plants of actual apparatus and operating practices.

Discussion by W. E. East of Toledo, H. W. Bromley of Youngstown, W. A. Wolls of Columbus, H. L. Wallau of Cleveland and William Long of Toledo proved instruct-

ive. The Toledo company by using Bailey boiler meters, at a cost of about $400 each on each boiler, is effecting a 10 per cent saving in coal. Labor troubles were also reviewed. Opinion as to the practicability of the bonus plan was about equally divided, although all conceded its advantages.

George E. Snider of Toledo, chairman of the meter committee, in his report said: "The labor situation during the last year has been an exceptionally difficult problem, due principally to the fact that the average age of the meter department employees is such that about 75 per cent of them come within the draft, and the loss from this cause, especially with the larger companies, has been difficult to replace. In most cases this situation has been met by employing female labor wherever possible. In clerical, repairing and shop-testing work the results obtained are very encouraging. In other cases it has been necessary for the time being to abandon some of the less important work and also lengthen the intervals between service tests to three years or three and one-half years on the smaller meters."

The report contained carefully prepared papers on three timely topics, namely, "Demand Meter Performances," by Charles P. Garman, Dayton, Ohio; "The Problem of Securing Training and Keeping Adequate Help in the Meter Department," by A. H. Bryant, Cleveland, and "Meter Record Systems," by Ray Wolford, Newark, Ohio. These papers showed the opinion and practice of many representative companies.

In the discussion George E. Miller of Cleveland declared that the present is an admirable time to change to a demand system of metering if any company is contemplating a change. Present high costs of equipment make it easy for people to understand investment costs in plant equipment on which demand charges are based. As indicative of present prices Mr. Miller cited a recent quotation on a 100-hp. tubular boiler, which amounted to $6,800. F. B. Steele of Dayton expressed the opinion that demand meters greatly reduce the number of complaints and help to settle those made by power customers. Mr. Wood of the Duquesne Light Company, Pittsburgh, Pa., said that while he could train girls to test meters as well and as cheaply as any men, he had been thus far prevented from using women on outside testing by an order of the industrial board. He will appeal to the Public Utilities Commission.

The report of the new-business co-operations committee was divided into two sections, one on commercial lighting and merchandising under Chairman C. E. Yacoll of Youngstown and another on industrial power and heating under Chairman F. B. Steele of Dayton. These committees had sensed the change in the times and had devoted a large part of their attention to the broader commercial problems and less to business-getting methods.

A summary of all papers presented before the committee conferences was contained in the report. The committee recommended that the Ohio Electric Light Association take out a membership in the American Electrochemical Society and authorize some member to attend its principal meetings to bring back information of value to central stations. It is believed the executive committee will act on this recommendation.

The discussion brought out that residence wiring business is proceeding at a lively pace in Sandusky, Dayton and other sections. Financing is not being done by central stations. At Dayton the new-business department is starting to sell $91,000 of 6 per cent preferred stock to finance necessary extensions to plant. Cash or time payment plan at $10 down and $15 a month is the terms. The minimum sale will be one share and the maximum twenty shares. Sale of the stock at 85 was authorized by the commission.

The year's work of the committee on transmission and distribution, under Chairman M. H. Wagner of Dayton, was divided into three main parts, namely: underground distribution, overhead distribution, and high-tension transmission. The underground section of the report summarized what the committee felt was best practice on routing and installation. Secondary systems and transformers were covered in the part on overhead construction. Switching, remote control and overhead protection were taken up under high tension.

Discussion of the report occupied almost an entire morning. Those who participated were H. B. Hibben of Cleveland; W. H. White, General Electric Company, Schenectady; Fred Alsaker, Chicago, Delta Star Electric Company; M. G. Lloyd, Washington, and W. E. Richards, Toledo.

Officers elected for the ensuing year are: President, A. L. Oppenheimer, Pomeroy; vice-president, C. H. Howell. Coshocton; secretary-treasurer, D. L. Gaskill, Greenville; executive committee, O. H. Hutchings of Dayton, F. H. Golding of Canton, Robert Lindsay of Cleveland, E. L. Franklin of Warren, W. A. Wolls of Columbus; finance committee, W. W. Freeman of Cincinnati, E. P. Matthews of Dayton and J. C. Martin. The standing committee chairmen are: Meter committee, Charles P. Garman, Dayton; illumination committee, F. C. Caldwell, Columbus; voltage standardization committee, H. L. Wallau, Cleveland; transmission and distribution committee, R. R. Krammes, Newark; station-operating committee, Henry B. Dates, Cleveland; new-business co-operations committee, commercial lighting and merchandising section, F. H. Hooper, Van Wert; industrial power and heating section, C. D. Carlson, Cleveland.

Hartford Employees Volunteer for Farms

Farm work is being efficiently performed by relays of central-station employees loaned for a week each by the Hartford (Conn.) Electric Light Company in the interest of patriotic crop production.

PREPARING STUDENTS FOR MILITARY SERVICE

Committee on Electrical Engineering of the Society for the Promotion of Engineering Education on the War Problems

A brief survey of the present status and future plans of the various institutions of the country, with respect to special preparation of electrical engineering students for military service, was made by the committee on electrical engineering at the recent meeting of the Society for the Promotion of Engineering Education at Evanston, Ill.

The changes for instruction in electrical engineering have been investigated at twenty-six representative institutions throughout the country. In twenty of these, says the committee, special courses have been conducted during the second semester in radio communication. In most instances equivalent credit has been granted for senior courses previously required for graduation. The general tendency seems to be to give credit in elective courses or for theses. Several institutions insist that all or a large portion of this credit be confined to courses outside of the School of Electrical Engineering. The committee calls special attention to this, in view of the fact that these radio courses are highly specialized and theoretical in nature and tend therefore to increase unduly the amount of instruction in pure electrical engineering at the expense of culture and general electives, which are very often given too little consideration in the education of an engineer.

Courses in radio communication, with the exception of code practice, have been pretty generally administered by the regular staff of instructors with the cooperation in many instances of the department of physics. The code practice has been administered either by local telegraph operators or by students or assistants who have become expert in the code as amateurs in wireless telegraphy. From four to five hours per week have been devoted to the code practice in most institutions reporting on this feature of the course. In some cases students were permitted to devote their own time to such work during hours when they were free, using as an incentive the fact that the Signal Corps recommends a proficiency of at least ten words per minute, and preferably twenty words per minute, for technically trained officers.

Although at the convention of the society last year in Washington, the committee adds, plans of the various institutions seemed to indicate that a large degree of intensification and possible shortening of the training in electrical engineering were anticipated for the year, comparatively little has been put into effect in the institutions investigated. In ten schools out of the twenty-six such a policy has been adopted. In most cases this involves merely the elimination of holidays and vacations, resulting in closing the institution from one to four weeks early this spring. In most instances a very positive statement was recorded to the effect that no further attempt would be made to intensify or shorten the course during the forthcoming year.

At four institutions only a summer session is planned for the present junior class in electrical engineering, with the idea of graduating this class in January or February. Several schools report a consideration of such a possibility with the later abandonment of the idea resulting from faculty vote or adverse student sentiment. With the expressed policy of the War Department and the navy to the effect that students in engineering, anticipating military service, should complete their regular courses, and with the provisions of the Naval, Signal and Engineering Reserves, the committee feels that the need for shortened and intensified courses has been pretty generally eliminated.

The demands for technical graduates in the military service have reopened in many instances consideration of the desirability of continuing university training for all classes throughout the year on the four-term basis. At Purdue University and one or two other institutions faculty committees are considering this possibility. So far as reported to the committee, however, the University of Washington is the only institution investigated where final decision has been made in favor of the four-term plan.

In many schools where either the faculty or the student body, or both, has defeated the plan for a summer session for senior electrical engineers, this fact would seem to indicate that the summer session of a four-term schedule would be neither popular with nor largely attended by engineering students. The personnel of both student body and faculty, and hence the nature and quality of the work accomplished, would probably be quite different as compared with the other three terms of the year.

With regard to plans for the forthcoming year, many schools are arranging for a considerable amount of extra military drill, particularly in institutions where such training has not been administered in the past. In a few cases it is planned to conduct a radio course throughout both semesters of the senior year rather than to concentrate this work in the second semester, as was generally the case during the past year.

The addition of new courses of special value during the war has been recognized in most instances to have a stabilizing effect upon the student body.

This war in magnitude, intensity and destructiveness exceeds every other calamity which has afflicted the human race. The side more likely to win is that which more quickly invents and successfully utilizes various engineering devices. To devise and employ these instruments engineers, and still more engineers, are needed. Whenever the war terminates there will be need for engineering skill to repair the destruction wrought. Educational methods should be quickly and effectively modified to anticipate or meet demands of the new world of experience and ideals. To "promote" engineering education we should concentrate on effective schemes for (a) more materials, more students attracted and held; (b) better methods, less wasted time; (c) better men, more pay for instructors to prevent the best men from going out of educational work.—*Prof. F. H. Newell before the Society for the Promotion of Engineering Education.*

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Conference Club.—The regular quarterly meeting of the Conference Club will be held in Schenectady, N. Y., on July 22 and 23. The General Electric Company is making arrangements for delegates' accommodations.

A. I. E. E., San Francisco Section.—J. C. Clark of Leland Stanford University has been elected chairman and Allen Jones, General Electric Company, secretary of the San Francisco Section of the A. I. E. E. for the coming year.

A. I. E. E., Rochester Section.—Following a dinner held by the section recently, R. H. Manson was elected chairman and W. W. C. Freeman, Stromberg-Carlson Telephone Manufacturing Company, was elected secretary for the year 1918-19.

A. I. E. E., Minnesota Section.—At the last meeting of the Minnesota Section the annual election resulted in the choice of F. A. Banert for chairman and F. D. Marshall for secretary. Captain Richard gave an instructive talk on trench warfare, dealing with personal experiences.

A. I. E. E., Panama Section.—W. L. Hersh was recently elected chairman and M. P. Benninger, Balboa Heights, C. Z., was elected secretary. The meeting of June 9 was given over to an inspection trip to the Central & South American Cable Company's ship Guardian, conducted by Mr. Hecksher.

New York Electrical Society.—At its last meeting, June 6, officers of the New York Electrical Society were elected for the coming year as follows: Arthur L. Doremus, president, and G. H. Guy, secretary. It is reported that tentative plans for next season, beginning in October, are well under way.

Portland Sections, N. E. L. A. and A. I. E. E.—At the final joint meeting of the Portland Sections of the N. E. L. A. and A. I. E. E., Prof. O. F. Stafford spoke on the "Utilization of Waste Wood for Producing Distillation Products and High B.t.u. Gas." R. M. Boykin was elected chairman and W. D. Scott secretary.

A. I. E. E., Erie Section.—H. O. Westendorf, General Electric Company, delivered a lecture on the subject of "Reversible Control Rudders," illustrated by slides and motion pictures, at the section meeting of June 11. Officers for the coming year have been elected as follows: Chairman, Clayton P. Yoder, and secretary, Scott S. Hill. The subject for discussion on this evening was "The Part Electricity Is Serving in the World War."

Washington Electrical Contractors' Association.—At the quarterly meeting of the Washington electrical contractors, Seattle, June 13, it was decided to adopt the constitution and by-laws of the National Association of Electrical Contractors and Dealers. This will be formally accomplished in September. Representatives from Spokane, Ellensburg, Yakima, Bellingham, Everett and Tacoma were present in addition to a large number of Seattle members. The officers of the Washington association are V. S. McKenny, president, and H. D. Allison, secretary.

British Columbia Contractors and Dealers.—The second annual meeting of the British Columbia Association of Electrical Contractors and Dealers will be held at Victoria, Aug. 16 and 17, 1918. An invitation is extended to all electrical men, including managers, power company men, wholesalers, engineers, contractors, retailers, salesmen, etc. Officials in charge of the meeting say that this is going to be the "greatest get-together electrical meeting ever held in western Canada." The secretary's address is 406 Yorkshire Building, Vancouver, B. C.

Illuminating Engineering Society.—The election of the following officers of the council for the fiscal year 1918-1919 was confirmed by the council on June 13. They were elected to fill the offices made vacant by expiration of terms: President, George A. Hoadley; general secretary, Clarence L. Law. The chairmen and secretaries of the sections are respectively: New York Section—Chairman, F. M. Feiker; secretary, L. C. Porter. New England Section—Chairman, H. F. Wallace; secretary, Horace W. Jordan. Philadelphia Section—Chairman, James D. Lee, Jr.; secretary, H. B. Anderson. Chicago Section—Chairman, A. O. Dicker; secretary, Frederic A. DeLay.

National District Heating Association.—Central stations which may be contemplating district steam heating in view of the fact that the rising cost of fuel may make this method economical may be interested in the report of an executive committee meeting of the National District Heating Association held at Cedar Point, Ohio, July 8 and 9. The advancement committee of this association is studying the question of accounting in combination companies and is ascertaining a profitable basis of operation for heating companies. The station-operating committee is discussing plant economies. The research committee and the educational committee have been collecting data on heating-company costs. A new committee has been created by the executive committee to co-operate with the Bureau of Standards in establishing rules for all heating companies. It has been decided to hold a convention in 1919, but the time and place have not been arranged. George W. Martin, New York, and D. L. Gaskill, Greenville, Ohio, were re-elected president and secretary-treasurer respectively for the coming year.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Delegation of Legislative Power.—An ordinance of a municipality passed pursuant to law which confers upon an administrative board authority to grant to a corporation the right to operate a public utility owned by the municipality, upon the terms and conditions specified in the ordinance, and empowers such board to perform certain specified administrative duties which are necessary to the carrying out of the plan provided for in the ordinance, does not thereby delegate legislative power in violation of the constitution, the Supreme Court of Ohio held (119 N. E., 735).

Increasing Height of Water.—The mere fact that after construction of a new dam water backed further up river than when the old dam was in use furnishes no criterion from which to measure the probable increase in the height of the dam, in the absence of proof of the additional depth of the back water, the Supreme Court of Iowa held in Walters versus Anamosa & Oxford Junction Light & Power Company (167 N. W., 765). Where flashboards were customarily used on an old dam builders of the new dam were entitled to maintain it, or flashboards above it, to the height of the flashboards on the old dam, since such boards are considered part of the dam.

Increasing Rates Pending Commission's Action.—Under the Public Service Commission's law prohibiting an increase in gas rates except after thirty days' notice to the commission accompanied with a schedule of the proposed new rates, a gas company has a full right, upon giving thirty days' notice to the commission and due publication thereafter, to file a schedule of increased gas rates, the New York Supreme Court held (170 N. Y. S., 692). Where gas company filed notice and schedule of proposed increase in charges and complaint was made thereupon the company, having by stipulation assumed the burden of proof of reasonableness of rates in any proceeding to fix rates, could not charge the proposed rates after the specified effective date of the new schedule until it had convinced the commission that the proposed new rates were just and reasonable. Offer of gas company which had filed schedule of higher rates, but had not convinced commission of justice and reasonableness thereof, to rebate any amounts received in excess of the old rate, if the commission should rule against it, did not entitle it to charge the proposed new rate pending determination by the commission.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Domestic Rate at Springfield Increased.—The rate for domestic light service at Springfield, Ohio, has been increased to 8 cents per kilowatt-hour. The franchise ordinance was amended in such a manner as to place future changes in the hands of the City Commissioners. This ordinance expires on Sept. 1, 1919.

Ohio Public Utilities Commission Will Decide Jurisdiction in Columbus Light Rate Case.—July 17 was the date set by the Ohio Public Utilities Commission for a hearing as to its jurisdiction in the matter of appeals from rate ordinances passed by the Columbus City Council by the Columbus Railway, Power & Light Company, the Columbus Gas & Fuel Company and the Federal Gas & Fuel Company. The Supreme Court recently rendered a decision to the effect that the commission has no authority to hear appeals from ordinances enacted prior to the creation of that body. The Columbus Railway, Power & Light Company is appealing from the action of the Council in reducing its service rate from 7 cents to 5 cents.

California Companies Seek Rate Increase.—The Southern Sierras Power Company, which supplies electricity in Inyo, Kern, San Bernardino and Riverside Counties, and the Holton Power Company, which supplies electricity in Imperial County, have filed with the Railroad Commission a joint application for authority to raise their rates. The application says that the two companies were organized under the same management, and in order to encourage and assist in the rapid upbuilding and development of the territory served low rates were made from the beginning and many reductions have also been given. The application says that the policy pursued has quickly built up a large and growing business, and the system is rapidly acquiring a good load, but no return upon the investment has been realized. The increased cost of labor and material since the war commenced, including the more than doubling of the price of fuel oil, the companies say, makes the increases necessary. The companies say the excess operating costs for the year 1918, due to increase in prices of labor and material and the increased use of oil-generated power as compared with 1915, amount to much more than $200,000 and are daily increasing. Moreover, in order to finance the urgently needed additions to hydro facilities, costing nearly $1,100,000, it is necessary that the companies' finances be in a sound condition.

Rate Increase Asked in California.—The Mount Whitney Power & Electric Company, Visalia, has asked the California Railroad Commission for permission to increase its electric rates by charging and collecting a temporary surcharge of 10 per cent on all bills.

Intercity Traffic by Electric Truck.—A. Jackson Marshall, secretary Electric Vehicle Section, National Electric Light Association, writes that in the Eastern States—for instance, on the New York-Philadelphia turnpike—the unusually heavy traffic has so torn up the roadbeds that high speed is impracticable for heavily laden trucks. Thus the slower speed of the electric is often sufficient to cover distances with speed nearly as great as, if not equal to, that of the gas truck. The trip between these cities has been conveniently made by electric trucks in a day. By charging batteries at Philadelphia and recharging or changing at Trenton and Newark sufficient power will be available for the entire trip. A demonstration of this character was made some time ago with a Ward electric truck. Following is the record of a trip from Newark to Camden, the latter city being just across the river from Philadelphia: Left Newark 6:30 a. m., arrived at Trenton 11:50, in Trenton from 11:50 a. m. to 3:30 p. m., arrived at Camden 8 p. m.; total mileage for the day, 110; total time on road, 9 hours 50 minutes; total ampere-hours consumed, 137.

The Opportunity in Electrical Engineering.—A booklet on "Electrical Engineering as a Profession" has been issued recently by the University of Arizona, Tucson. G. M. Butler is dean of the College of Mines and Engineering of the university. It calls attention to "an unparalleled opportunity" and a duty as follows: Never has the work of engineers, no matter what branch they follow, been in such demand as it promises to be during the next generation. Every sign points to the rapid approach of the engineering millennium, if, indeed, it has not already arrived, and wise is the young man who equips himself now to reap the harvest that is imminent. . . . In Europe after the war whole cities must be rebuilt, hundreds of bridges replaced, a great merchant marine provided, many mines reopened and re-equipped, and an almost countless number of highways, railroads, water works, power plants, transmission lines and manufacturing establishments repaired and improved or diverted from martial to peaceful uses. . . . Never has such a gigantic task confronted any profession, and it cannot be doubted that the rewards will be commensurate with the needs and opportunities. Not only is it true that after the war there will immediately develop an unprecedented demand for engineers, but it is a well-recognized fact that this is an engineers' war, and it is absolutely essential that thousands of engineers be trained for our own army and those of our allies if we are to hasten the coming of a victorious peace."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Cutting Red Tape.—In deciding to authorize advances in rates in a recent case affecting different classes of utility service in combined companies the Illinois Public Utilities Commission says: "This is an emergency case. The government of the United States requests that all public utilities shall be maintained at the highest possible state of efficiency and yet conserve all the fuel and materials possible, consistent with the maintenance of their efficiency. The commission considers that for the purposes of this case it is not necessary to make a complete separation of the various units of property that constitute such a combined plant of a single company, and at this time the commission will consider, among other things, whether the increased rates proposed will yield a reasonable rate of return on the fair value of the combined property of such utility during the present emergency."

Canvass Among Consumers on Rate Increase.—In allowing an increase to rates of the East St. Louis & Interurban Water Company, the Illinois Public Utilities Commission took into consideration the results of a canvass among consumers. "The witness Riley," the report of the proceedings says, "testified that in the East St. Louis district some thirty-three consumers would be affected by the proposed rates, which would result in a total increase in revenue of $40,194, and in the Granite City district twenty-one accounts would be increased with a net increase of $15,910. Some attempt was made on the part of the applicant to obtain the consents of the consumers to be affected, and the results of this canvass of consumers are given by the witness. He states that in the East St. Louis district the company has signed consents from consumers who will pay 16 per cent of the revenue increase and that verbal consents were obtained from consumers representing 7 per cent of the proposed increase. There are accounts of stock yards and packing houses, which represent 50 per cent of the proposed increase, from which no consent could be obtained. The remaining 27 per cent of increase is to come from twelve railroad accounts, and the witness stated that he has not interviewed these consumers, owing to the relation existing between them and the federal government. In the Granite City district consent was secured from consumers who represent 87 per cent of the proposed increases, the total remaining 13 per cent representing railroad consumers who were not interviewed for the reason just given."

Men of the Industry

Changes in Personnel and Position— Biographical Notes

R. M. Little, formerly a trustee of the American Museum of Safety, has been elected director of the Museum, succeeding Arthur H. Young, resigned.

Harold M. McClure of Lewisburg, Pa., has been appointed a member of the Pennsylvania Public Service Commission, succeeding Robert K. Young, deceased.

M. L. Derge has resigned as manager of the Salina (Kan.) Light, Power & Gas Company, to become connected with the Trumbull Manufacturing Company at Warren, Ohio.

John B. Fisken, for many years head of the light and power system of the Washington Water Power Company, has been advanced to be chief engineer, succeeding Carl F. Uhden.

Arthur H. Young, who succeeded Dr. W. H. Tolman as director of the American Museum of Safety on Jan. 1, 1917, has resigned to take charge of the employees' relations department of the International Harvester Company. He will continue, however, as vice-president of the Museum.

T. F. Grover has resigned as vice-president and general manager of the Chicago, South Bend & Northern Indiana Railway Company and the Southern Michigan Railway Company. For the last year Mr. Grover has been operating these properties as well as the Terre Haute, Indianapolis & Eastern Railway Company. Prior to that time Mr. Grover was general manager of the Terre Haute company, in charge of both the electric lighting and railway business for more than ten years. In the last twenty-eight years he has been continuously connected with public utility businesses. He has been president of the Fond du Lac Street Railway & Light Company, the Fond du Lac Gas Company and the Fond du Lac & Oshkosh Railway Company and was vice-president and general manager of the Eastern Wisconsin Railway & Light Company. Mr. Grover expects to enjoy a vacation for a few months.

F. W. Ballard, former commissioner of light and heat for the city of Cleveland, Ohio, has been appointed power specialist attached to the office of the vice-president of the United States Shipping Board Emergency Fleet Corporation, in charge of construction. Mr. Ballard will be in charge of the interests of the corporation in the matter of power requirements for shipbuilding and associated industries. In these matters he will act as the personal representative of the vice-president. Before his appointment at the beginning of 1912 as constructing engineer for the Cleveland municipal plant he was manager of the engineering and construction department of the Sherwin-Williams Company. While in the employ of the city of Cleveland he frequently acted for other municipalities in an advisory capacity with regard to the local relations of cities with lighting companies. Late in 1915 he was retained by the city of Philadelphia to assist in the appraisal of the property of the Philadelphia Electric Company.

Willard B. Felton, first engineer of the Arkansas Valley Railway Light & Power Company's Pueblo plant, has joined the United States Marines.

J. E. Davidson, vice-president and general manager of the Nebraska Power Company, Omaha, Neb., was re-elected president of the Nebraska Electric Association at its recent convention in Omaha. Mr. Davidson has always been very prominent in N. E. L. A. activities, having been secretary and treasurer of the Michigan Electric Association 1900-1901, president of the Vermont Electric Association 1909, chairman of the New England Section

J. E. DAVIDSON

of the N. E. L. A. 1910-1911, president of the Northwest Electric Association 1911-1912, chairman of the Portland (Ore.) Section of the N. E. L. A. 1915-1916, and chairman of the executive committee of the Northwest Section of the N. E. L. A. 1915-1917. Mr. Davidson was formerly with the public utility companies at Port Huron, Mich., and since then has been president and manager of the Consolidated Lighting Company, Montpelier, Vt., and vice-president and general manager of the Pacific Power & Light Company, Portland, Ore.

Martin H. Clapp, formerly telegrapn superintendent of the Northern Pacific Railroad and president of the Association of Railroad Telegraph Superintendents, has been appointed manager of the telegraph section, division of operation of the United States Railroad Administration, with office in the Southern Railway Building, Washington, D. C. Mr. Clapp will have supervision over telegraph and telephone lines belonging to the railroads under federal control.

H. A. Joslin has been transferred from the position of manager of the Eugene office to be manager of the Dallas office of the Oregon Power Company, succeeding R. U. Steelquist.

W. E. Quillin, new-business manager of the Lorain County Electric Company, has been transferred by the Doherty Organization to the Salina (Kan.) Light, Power & Gas Company as manager. Mr. Quillin has been with the Doherty Organization since 1907, when he joined the new-business staff of the Lincoln (Neb.) Gas & Electric Light Company. He was a graduate in electrical engineering at Purdue University and secured his first position with the General Electric Company. Later he was with the Terre Haute, Indianapolis & Eastern Railway and then went to the Doherty Company.

Martin J. Insull, who as announced in the June 15 issue of the ELECTRICAL WORLD was elected second vice-president of the National Electric Light Association, is senior vice-president of the Middle West Utilities Company, Chicago. Mr. Insull was born in Reading, England, Sept. 18, 1869, and received his education in the City of London Middle Class School and at Cornell University, being graduated from the latter institution as mechanical engineer in 1893. Previous to leaving England in March, 1887, he spent two or three years in the telephone business. Upon arrival in the United States he entered the shops of the Edison Machine Works, Schenectady, N. Y. On leaving college he became a partner of Sargent & Lundy for five years, when he started the Martin J. Insull Company, manufacturers' agents. About a year later this business was turned over to the General Incandescent Arc Light Company of New York, and Mr. Insull then went to New York as vice-president and general manager of the company and the New York Electric Equipment Company. About three years later the General Incandescent Arc Light Company was acquired by the General Electric Company and the plant moved to Pittsfield. Mr. Insull continued with the company as president until its merger with the Stanley company, when he became second vice-president of the Stanley G. I. Manufacturing Company, having charge of its Middle West business, with offices in Chicago. In 1906 he resigned to go to New Albany, Ind., to take charge of the gas, electric lighting, water and railway properties in and around New Albany and Jeffersonville. In 1912 these properties among others were taken over by the Middle West Utilities Company, and Mr. Insull went to Chicago as senior vice-president of the company, which position he still retains.

Obituary

Charles A. Wilkinson, engineer of the power station of the electric department of the Flatbush Gas Company, Brooklyn, N. Y., died on June 24, at the age of fifty-three years.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

CLEANER MANUFACTURER CHARGED WITH PRICE FIXING

Federal Trade Commission Asserts that Trade Methods of United Electric Company Tend to Eliminate Competition

The United Electric Company, Canton, Ohio, licensed manufacturer under the Kenney patents of stationary ("Tuec") and power portable ("Ohio") vacuum cleaners, has been served by the Federal Trade Commission with a complaint charging illegal price fixing.

In its complaint the commission charges the company with violation of Section 5 of the Federal Trade Commission act as follows:

"That with the intent, purpose and effect of stifling and suppressing competition in the manufacture, marketing and selling and reselling of its vacuum cleaning machines in the course of such commerce, and as a means of securing the trade of dealers and obtaining their aid and co-operation in enlarging the sale of its price-maintained machines to the prejudice and injury of its competitors, and with the purpose of eliminating competition in the selling price among the various dealers in its machines and thereby depriving the dealers of their freedom to sell such machines at prices which in their judgment would be warranted by trade conditions, and for the purpose of preventing competitors of the parties who purchase its machines from entering into free competition in the sale and distribution of products manufactured by the United Electric Company, and for other purposes, the respondent, United Electric Company. has fixed and maintained specified standard prices at which the machines manufactured and sold by it shall be resold by the purchaser thereof and requires its purchasers to agree to maintain such standard selling prices; and for the purpose of maintaining said standard resale prices and of inducing and compelling its customers to maintain and keep such standard prices, and for the purpose of preventing those who do not maintain such standard prices from entering into free and regular unsuppressed and unhindered competition with purchasers who do maintain such standard prices, the respondent for more than six months last past has refused, and still is refusing, to sell its products to customers or dealers who will not agree to maintain such specified standard resale prices or who do not resell such products at the specified standard selling prices which are fixed and determined by the respondent, as aforesaid."

The company is also charged with violation of Section 3 of the Clayton act in that for more than the past two years it has, in the course of interstate commerce, "made contracts for sale and is now selling and making contracts for sale of large quantities of such vacuum cleaning machines for use, consumption and resale within the United States, and has fixed and is now fixing the price charged therefor or discount from or rebates upon such price, on condition, agreement or understanding that the purchaser thereof shall not use or deal in the goods, ware, merchandise, supplies or other commodities of competitors of respondent, and that the effect of such sales and contracts for sale, or such conditions, agreements or understandings, may be, and is, substantially to lessen competition or to tend to create a monopoly in the vacuum cleaning machine industry."

A hearing will be held at Washington on Aug. 20.

The Kenney patent license, under which the manufacturer operates, does not restrict the licensee in any way as to price.

The United Electric Company, in answer to a telegram from the ELECTRICAL WORLD asking for a statement regarding these charges, says:

"Will say the Federal Trade Commission has preferred charges against us for the alleged refusal to sell to dealers who cut retail prices.

"It is a fact we have a fixed wholesale price, but we have never refused to sell a dealer, provided his credit is good. Where these charges originated we do not know, but believe it was either in New York or in our Middle West territory. We believe there is nothing serious involved, for the reason that we are like all other manufacturers in appointing representatives for exclusive territories. The vacuum cleaner business has not developed to a point where the machines can be sold like sugar or any other staple article, although we believe the time is coming when they will be handled in like manner."

JOBBERS SUPPLYING MOTORS FOR SERVICE IN WAR WORK

Despite Scarcity of Larger Sizes, Manufacturers State Many Motors Can Be Supplied for Immediate Delivery for Local Stocks

In view of the intense activity of electric motor manufacturers on war work, it is doubtful if the vigorous efforts the more progressive jobbing houses are making to furnish such equipment for government and allied service are generally realized. For many months these jobbers have striven hard to maintain stocks of motors for immediate delivery, and gradually quite a substantial reserve has been accumulated in the moderate and smaller sizes, notably in New England. Stock sheets go out regularly to various addresses in the trade likely to be interested, but there is no doubt that there is room for a decided enlargement in mailing lists. There is still a good deal of lost motion, so to speak, in locating motors available for immediate shipment, and it is advisable for engineers, dealers and industrial buyers to get their names on these mailing lists without loss of time where there is any prospect of more motors being needed. Cases are not wanting where the buyer has gone so far as to be willing to pay more for second-hand equipment because of immediate delivery prospects than for new designs of apparatus.

To illustrate the service the jobber is performing in motor supply at the present time, one jobbing house alone, the New England Engineering Company of Waterbury, Conn., shipped from stock in a single week four 25-hp. motors to a munitions plant in New Jersey; two motors of the same rating to a munitions plant in Meriden, Conn., and a Waterbury munitions plant was furnished with about $9,000 in motors, all from stock. This one concern—and of course there are many other jobbers very active in war work—carries at present $25,000 in motors on its warehouse floor ready for immediate shipment, and a like amount on order, all of which are due for early delivery.

Such instances show that, despite admitted scarcities in motors of sizes from 25 hp. up, and especially over 100 hp., there are now to be found many motors ready for immediate service, singly or in groups, subject to shipment from the jobber's stockroom upon receipt of order. The manufacturers are accumulating some stocks of motors in the smaller ranges of size also, but the buyer who wants power at the earliest possible moment, even at some sacrifice in the efficiency of the rush installation, should not overlook the jobber.

THE WEEK
IN TRADE

ADVANCING costs of doing business are being discussed by jobbers who are evidently making an effort to obtain a better margin of profit. One example of yielding to this argument is afforded by an Eastern manufacturer who recently announced an additional 10 per cent discount on a large part of his line. A higher price has been tacked on to a number of other staple articles. It is also intimated that further price increases may be expected before long.

In the Pacific Northwest and on the coast building activities are pronounced in both industrial and residential work. This is also true of the Southwest, where a large volume of work is under way. The United States Railroad Administration has issued a circular giving in detail instructions aimed to speed the loading and unloading of cars.

Crops and their prospective yields for the season are a factor of importance to the trade. For the week ended July 6 winter wheat was regarded favorably and corn reported as coming on in fine shape. Good reports are made on spring wheat and alfalfa, but the oat crop is not so optimistically considered as in 1917.

Collections are reported to be improving and in some sections are excellent. It is said that jobbers' paper in the hands of manufacturers has increased 75 per cent over last year. Credits are firm.

NEW YORK

Jobbers are not criticising the current condition of business, which is on a high level as to volume; but they say they do object to the margin of profit, which, comparatively speaking, is about that of normal times. The distinction between volume, which has increased fully 100 per cent, and the value of transactions, which has not grown in proportion, is clearly discernible; and it becomes increasingly apparent with the tightening of war restrictions.

Prices continue to increase, although in quite a few instances the peak was supposed to have been reached some time ago.

Collections are reported from good to prompt, favorable comment being made on the manner in which jobbers and dealers are meeting the short credit terms enforced on different lines.

FUSES.—A steady growing demand for fuses, especially of the renewable types, is noted. On this line jobbers, as a rule, are buying in larger quantities.

SEAMLESS TUBING.—On July 8 the government commandeered all the brass and copper tubing used largely by the electrical trade and prohibited shipments unless under special order. The effect on the market and supply for commercial purposes is not yet apparent.

INDUSTRIAL MOTORS.—In the last two weeks, or possibly more, a falling off in the demand for industrial motors of from 25 hp. to 250 hp. rating has unaccountably taken place. Various reasons are given for this decline. It is generally ascribed, however, to the shifting of the business from the Eastern section to the West, where the government is making its necessary expansion in industrial activities in connection with the production of war materal. An increase in price is looked for. Deliveries are still far back —from three months to two years, according to size and type.

LAMPS.—The 10 per cent advance announced as effective July 1 on gem and miniature lamps also applies to carbons. These revised prices are held by a prominent producer as being inadequate to meet the increasing manufacturing costs. It is further believed in certain quarters that there will be a shortage of glass in the fall on account of insufficient and unsatisfactory basic material. Shortage of competent labor is also a factor. The government is buying enormous quantities of carbon lamps, but for what purpose is not known. One large manufacturer will accept no further orders for carbons this season. Stocks on standard sizes of metal-filament lamps are heavy and growng larger; in fact, it is said there never were so many amps of these types at the factories as at the present time.

BELLS AND GONGS.—Trade is active, with sales increasing. Inside of a month one manufacturer, who said the revision was general, increased his prices from 10 to 25 per cent.

FANS.—Unseasonable weather has interfered with the anticipated rapid movement of fans. Four-blade fans of 12 in. and 16 in. are scarce. There is quite a heavy reserve stock of 12-in. six-blade fans in the hands of one manufacturer, which, it is expected, will be quickly taken up with the first warm spell.

WASHING MACHINES.—On July 15 an Eastern distributer advanced prices on all types of electric washers from 7 to 10 per cent. Two Western manufacturers have also sent out advanced prices on their products.

HEATING APPLIANCES.—Advances in the heating device license schedule effective Aug. 10 are made all along the line. Regular 6-lb. irons go from $5 to $6 and toasters likewise. Grills, toaster and disk stoves, rectangular heating plates, percolators and other hollow ware, immersion heaters, air heaters, soldering irons, flatirons and a number of other devices are included in the advance. Furthermore, central stations and holding companies purchasing to the extent of a certain fixed amount annually may receive a better discount for purchases made after Aug. 10.

COLLECTIONS AND CREDITS.—Generally speaking, credits are very satisfactory. One distributing concern having large manufacturing interests stated that its usual practice was to extend a credit of sixty days to jobbers, but prompt settlement was required. The customers of this house understood the policy, and it is rarely called upon to eliminate a delinquent debtor. The feasibility of the thirty-day collection period is questioned by some jobbers, who say bills are seldom met under forty, fifty and even sixty days.

SCHEDULE MATERIAL.—Harvey Hubbell, Inc., Bridgeport, Conn., announces as of July 10 a 10 per cent discount additional on the following items: Reflectors, shade holders (contractile collar type), lamp guards, hull switches, toggle snap switches, incandescent attachments for oil lamps, bead chain (in bulk), pull socket attachments, insulating and splicing links, candelabra fittings, direct threading shade holders, flush plates, toggle switches, automobile and battery circuits.

CABLE AND COVERED WIRE.—One manufacturer, operating on a rubber-covered base of 31 cents a pound, which possibly may be raised to 34 cents, announced an increase of 3 cents a pound, effective July 5, on all wire and cable. The increase in the cost of copper, cotton, tin, braid, labor, paint in compound and rubber has occasioned the revision. The same company on June 28 advanced its price on braid from $2.50 to $5 per 1000 ft. on No. 14. The increase involved is about 40 to 100 per cent for braids from No. 14 up. This concern has 600,000 ft. of No. 14 in stock, and jobbers in this territory also have heavy stocks, but neither the firm nor the jobbers have enough to fill orders 100 per cent. About 65 per cent is the rule on commercial requirements. Another important manufacturer with a 37-cent base increased his covered wire and cable prices 2½ cents a pound July 6.

STORAGE BATTERIES.—Manufacturers of standard storage batteries have been increasing their prices. On or about July 1 an Eastern manufacturer of prominence advanced his list 10 to 15 per cent on all types, with the exception of automobile batteries, which went up 10 per cent, owing to the increased cost of labor and rubber, lead and other material. Deliveries are dilatory. This company is finding it very difficult to obtain material to fill commercial orders.

CHICAGO

The past week has been rather quiet in Chicago jobbing circles. Announcement has been made by government officials of a large new camp for the training of 53,000 men to be constructed at West Point, near Louisville, Ky. One of the biggest building permits of the year issued in Minneapolis has been taken out by the Minneapolis General Electric Company, covering an extension to the power house to be erected at a cost of approximately $485,000. The extension to the plant will double the company's present steam generating capacity.

LAMPS.—Stocks of jobbers continue to improve. "Gem" lamps are up 10 per cent to a 24-cent base. This is the second 2-cent increase since the first of the year. Automobile and flashlight lamps have also increased about 10 per cent. The sales of carbon lamps are reported by some jobbers to be off 15 per cent to 20 per cent. It is expected in some quarters that this falling off will gradually increase as the demands for fuel-saving become more urgent.

FANS.—While fan stocks in Chicago are still intact no one is despairing. It is remembered that last year the real fan season was in August.

COPPER WIRE.—Copper wire is quoted as follows: Rubber-covered at 34 cents, weatherproof at 32 cents and lamp cord at 33 cents.

SOOT BLOWERS.—One manufacturer of soot blowers is having difficulty with production owing to difficulty in getting chain. Blowers are being shipped to customers with instructions to secure chain locally.

LIGHT FIXTURES.—Thirty-five thousand dollars' worth of business has been turned over by one manufacturer of commercial lighting fixtures to his competitors because of his inability to handle the volume at hand.

TRANSFORMERS.—Transformer manufacturers are doing a large amount of government work, but are now in a position to use some domestic business and are looking for orders.

METERS.—The domestic meter business is reported to be very poor, but the export trade continues to keep some factories supplied.

BOSTON

The demands of war work continue to drive the wheels of industry at top speed, and trade goes on with no sign of the customary summer recession. The increasing scarcity of trained men is becoming a serious factor in the dispatch of business. More and more women are coming into the field, but the factories and stores, jobbing houses and utilities are still far from the anticipated maximum of female assistance which must be realized if the war continues a year or two more. Some improvement is to be seen in deliveries involving short hauls to the buyer, but the longer hauls are still handicapped by railroad congestion and shortage of marine carriers.

The first destroyer to be built at the Squantum plant was scheduled for launching early this week. The merchant marine grows apace, and so does the market for wiring and lamps for service on shipboard. Unrest is evident in the labor field. The central stations weathered the recent strike of linemen in eastern Massachusetts without interruption of service and are forcing their power equipment for war work all through this section. About 10 per cent of the employees of the Lynn (Mass.) factories of the General Electric Company attended a strike meeting at the end of last week, and it was expected that an attempt would be made to interrupt production in this way early this week; but at last accounts the company had the situation well in hand. Jobbers' stocks are large in most lines, and at last some signs of life appear in the sale of fans.

COLLECTIONS AND CREDITS.—Collections are reported to be on a firm basis at this time. Some anxiety is felt regarding the extension of taxation in the war revenue bill to commodities of higher quality, but it is expected that readjustment will be effected in a patriotic spirit and the fundamental soundness of the electrical trade is undisputed. Just at present collections are unusually prompt in the Connecticut valley. Munitions work is the basis of so much activity to-day that there is no ground for pessimism.

CONDUIT.—Long-sighted buyers are reaping the reward of their provision in the arrival of occasional carload lots of pipe, but the general supply is uneven in flow and in distribution. Prices show little change. A fair demand is now noted for even the smaller sizes of pipe, probably for use on shipboard. Some jobbers are still quite well stocked with conduit, while others are buying from hand to mouth and are worried about the future supply.

FIXTURES.—A fair trade is now being enjoyed in fixtures, despite the reduction of new residence construction to the minimum. Daylight saving has had no appreciable effect on the trade, according to one of the largest houses. Of course, stocks are unusually large, and prices are at times shaded to stimulate buying, but many summer residences of the best class are being refitted. High wages are also leading the laboring class to buy fixtures on a hitherto unprecedented scale. It would perhaps be untrue to characterize the fixture trade as undergoing a boom, but it is far from moribund, and the outlook for the fall is much better than it was feared would be the case.

STORAGE BATTERIES.—The demand for automobile ignition and lighting batteries continues heavy. A representative dealer is maintaining excellent stocks by means of boat shipments from Long Island. Prices are firm, and although a large amount of rebuilding of cells is a feature of the trade, the sale of new equipments continues at the previous high rates of buying.

APPLIANCES.—Warmer weather is at last causing the sale of fans on a somewhat larger scale, but the chances are that 1918 will go down into electrical trade history as one of the poorest fan years ever experienced. Here and there dealers have had exceptionally good sales, but chiefly in cases where the government was an early purchaser, as at the Springfield Armory. This year there have been a good many table appliance sales for wedding gifts, and some of the high-class jewelers and silversmiths are retailing grills, percolators and toasters to good advantage. Sewing-machine motors are moving well, and flatirons are always in good demand.

MOTORS.—Little change is to be seen compared with last week. If anything, stocks are improving from week to week, but the demand for particular sizes is spasmodic, and the larger units (above 75 hp.) are still difficult to obtain at once. Jobbers, however, are giving special attention to the collection of varied sizes for immediate delivery.

ATLANTA

There is very little change to be noted this week. Standard materials and staples are moving steadily. Commercial lines are being further subordinated to government callings, and the bulk of transactions appear to be along so-called essential lines. Heavy investments are being made in Southern industrial enterprises, especially for government account. These include a new powder plant at Louisville, Ky., dry docks at Norfolk, Va., and a steel-fabricating plant at Birmingham, Ala. The Mandeville Mills, Carrollton, Ga., and the Okeh Manufacturing Company, Greenville, S. C., will erect new yarn mills. A more liberal view is being taken regarding devices at military camps, and it is expected that appliances will move more freely to these quarters. An authority states that the government has placed an order for 15,000 fans.

There is a large volume of work under way and well distributed, and present indications point to continued activity for some time to come. A number of Southeastern concerns have done practically nothing but government work for the past year, which has thrown the industrial work to others now not actively engaged on government jobs. Workmen are still in big demand, and the supply grows less each day as the draft makes itself felt.

DRY BATTERIES.—This week shows a creditable increase in the demand for dry cells. The market for these has been sluggish during the past few months. Stocks are away below normal, and shipments are poor.

CREDITS AND COLLECTIONS.—Manufacturers' collections are showing up fairly well so far this month, being about the same as June, which was slightly off compared with May. Collections from municipalities are lagging and away off in a number of cases. Retailers', contractors' and jobbers' collections are good and compare favorably with the past few months. On the whole, the amount of jobbers' paper held by the manufacturers has increased materially of late and may be estimated as 75 per cent greater than in the same period a year ago. This is accounted for by the fact that the jobbers are buying in larger quantities in order to secure shipments and at correspondingly higher values. Then, too, government takings being still heavy, the jobber has to wait for these accounts to be vouchered through the proper departments. Numerous requests for time extensions from central stations are being received by the manufacturers, and while the utilities are experiencing great difficulty in financing it is not expected that the call for note payments will be other than temporary.

CABLE.—Although the demand for heavy sizes has lessened of late, there is a potential market for all sizes as soon as less uncertainty is felt. The Standard Underground Cable Company secured an order for approximately $40,000 worth of assorted lead-covered cable this week from the Georgia Railway & Power Company.

SAN FRANCISCO

There has not been any material change in general business conditions. Collections remain good. The orders received cover largely commodities required for the maintenance and completion of industrial installations.

The Moore Shipbuilding Company in Oakland has been awarded a contract to build twenty-two freighters, which will involve an expenditure of $16,000,000.

FIXTURES.—The decrease in building construction has had a proportionate effect with the electrical fixture manufacturer, business in this line being somewhat quiet at present, although there has been a little activity in the repair and alteration work.

LAMPS.—Supplies are still accumulating stocks of the regular large types as protection against an anticipated heavy fall demand. Good stocks are available of flashlight lamps, but only scattered stocks can be found of automobile lamps, and even such stock is not complete, there being a ready sale for the headlight bulbs.

FLOODLAMPS.—There seems to be a general slowing up on the demand. Unquestionably inquiries for prospective installations will commence with the approaching shorter days.

WASHING MACHINES.—There is no supply to speak of on the large family size. The demand is good, and no immediate shipments can be expected from the factories. Stocks of the smaller-sized washers are rapidly coming down to a minimum.

ELECTRIC IRONS.—This is another article that is selling well, and it is felt the latest price advance will not cause a falling off in the volume of sales. In fact, unless overdue shipments are received shortly, the present supply will not meet the demand.

SEATTLE

Business conditions continue satisfactory, with general confidence in the future denoted by considerable advance buying. The volume is predicated on the war foundation and government buying program expanding. Collections continue on the same satisfactory level that has characterized the last few months. Higher freight rates are tending to advance prices along some lines. The increasing prices are also superinduced by the commandeering of steel by the government. The increase in prices over last week is not marked excepting on wire, which made a slight advance. Jobbers report a satisfactory increase in sales, particularly on household devices. Washing machines especially show a pleasing advance. Inquiries for power apparatus for lumber mills to be electrified are scattering. Few new projects developed during the week. Dealers are buying everything they can get in an effort to replenish depleted stocks. Great difficulty is encountered in getting certain classes of materials on account of heavy government demands, which have priority.

No improvement is noted or in prospect on the freight situation, and statements heretofore made regarding the labor situation still hold true. The shortage of labor is daily becoming more acute. Prospects for stupendous increases in the volume of trade in the Northwest with the Orient, especially in the event of America going to Russia's aid, are being generally discussed.

Working drawings are completed for houses to be erected by the bureau of housing at the Puget Sound Navy Yard at Bremerton. The plans provide for a large hotel, an apartment house and 350 bungalows.

CONDUIT.—The situation shows no improvement.

LAMPS.—Smaller sizes are coming through well and stocks are in fair condition. The larger sizes are very hard to obtain. Automobile lamps are very scarce, and the demand is brisk and increasing. The industrial demands are quite large.

METAL MARKET SITUATION

Commercial Consumers of Copper in Quandary Over New Price Contracts for Third Quarter

It appears that the unexpected advance in the price of copper from 23.50 cents a pound in carload lots or more to 26 cents is placing some manufacturing consumers in an embarrassing position. Considering the government's prior order fixing Aug. 15 as the limitation of the old price, they accepted orders for finished merchandise and material at the lower figure. Therefore when the cost of the metal went suddenly to 26 cents on July 2 the manufacturers were in a predicament. At a meeting of the large brass and wire manufacturers held July 10 this question was thoroughly gone over, and a committee was appointed to confer with the copper producers and the War Industries Board for a discussion and settlement of the matter. It is understood that all contracts drawn for third quarter shipment at 23.50 cents and 24.75 cents (jobbers' price) will be delivered according to agreement. There is a possibility of copper being placed on an official basis of from 28 cents to 30 cents a pound on Aug. 15.

Lead continues very scarce and such quantities as are being offered are selling at a premium. The present quotation of 8.05 cents a pound at New York will probably remain unchanged, although one wire and cable manufacturer has now established a 9-cent base for lead and another one a 10-cent base. The latter has withdrawn entirely from the tin and lead market. Brass has advanced 2 cents a pound. Tin is still high and scarce. Slight variations of price occur in old metals.

NEW YORK METAL MARKET PRICES

	July 8	July 15
Copper:	£ s d	£ s d
London, standard spot	110 0 0	No 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	30.00	29.25
Lead, trust price	8.05	8.05
Antimony	13.00 to 13.37½	13.12½ to 13.25
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	Govt. price	Govt. price
Spelter, spot	8.80 to 8.90	8.80 to 8.90
Tin, Chinese*	$1.00	$1.00
Aluminum, 98 to 99 per cent	Govt. price †33.00	Govt. price †33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23.00 to 23.50	23.50 to 24.00
Brass, heavy	14.00 to 14.50	14.00 to 14.50
Brass, light	12.00 to 12.25	12.00 to 12.25
Lead, heavy	7.12½ to 7.50	7.12½ to 7.50
Zinc, old scrap	6.50 to 6.75	6.50 to 6.75

* No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb. 1-ton to 14-ton lots, 33.20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10% to 57.25
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10% to 66.75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10% to $97.75
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10% to 126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to list
Coil to 1000 ft	5% to 15%
	No. 12 Solid
Less than coil	+20% to list
Coil to 1000 ft	5% to 15%

Twin-Conductor

	No. 14 Solid
Less than coil	$80.00 to 5%
Coil to 1000 ft	75.00 to 5%
	No. 12 Solid
Less than coil	+20% to +5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	$24.00 to 12%
1/5 to std. pkg	19.80 to 20%
Std. pkg	18.75 to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std. pkg	List to 20%
Std. pkg	25% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35 to $0.36	.35 to $0.36
50 to barrel	.31 to .32	.32 to .33
Barrel lots	.28 to .289	.29 to .299

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.3190 to $0.3220	.3290 to $0.3320
Barrel lots	.2890 to .2920	.2990 to .3020

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
3/8	250	$5.00
1/2	250	7.50
3/4	100	10.00
1	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 100 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.	$75.00	$63.75 to 69.75
3/8-in. d. stp.	75.00 to $82.50	72.00 to 75.00
1/2-in. s. stp.	100.00	85.00 to 93.00
1/2-in. d. stp.	100.00 to 110.00	96.00 to 100.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75.00	$63.75 to $64.25
3/8-in. double strip	78.75	71.25
1/2-in. single strip	100.00	85.00
1/2-in. double strip	105.00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
3/8	$0.05 1/2	1	$0.25
1/2	.06	1 1/4	.33
3/4	.09	1 1/2	.40
3/4	.12	1 1/4	.47
3/4	.15	2	.55
1	.18	2 1/2	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
3/8-in.—	$25.00–$55.00	$24.00–$24.45	$21.50–$23.00
1/2-in.—	$30.00–$60.00	$27.00–$28.00	$23.50–$26.00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
3/8-in.—	$60.00	$30.00	$26.50
1/2-in.—	$65.00	$32.50	$29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 39

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37 1/2
2 1/2	.58 1/2
3	.76 1/2

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1 1/2 in.	2 in. to 3 in.
Less than 2500 lb	12%	14%
2500 to 5000 lb	15%	17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 to 1 1/2 in.	2 to 3 in.
Less than 2500 lb	1.5% to 6.8%	4.5% to 10.7%
2500-5000 lb	3.5% to 8.8%	6.5% to 12.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6.00
Discount	30%

CHICAGO

List price	$5.00 to $6.00
Discount	30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41% to 50%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5.00 to $7.00
1/5 to std. pkg	4.50 to 4.75
Standard packages, 500. List, each	$0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$7.00
1/5 to std. pkg	5.75
Standard packages, 500. List, each,	$0.07

LAMPS, MAZDA

105 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round Bulbs, 3¼-in., Frosted:		
60-watt—G 30	24	.77
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg.	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$29.13 to $35.90
Coil to 1000 ft.	25.22 to 26.95

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$29.00 to $30.00
Coil to 1000 ft.	21.50 to 25.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$21.75 to $30.00

OUTLET BOXES

Nos.	List, Per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25% to 33%	20% to 27%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80 to $38.00
1/5 to std. pkg.	14.80 to 19.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80
1/5 to std. pkg.	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$11.85 to $20.00	$30.75
1/5 to std. pkg.	11.10 to 15.60	24.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$9.48 to 11.85	$20.75 to $30.75
1/5 to std. pkg.	8.88 to 11.10	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+ 10% to 10%
1/5 to std. pkg.	5% to 8%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List to 10%
1/5 std. pkg.	16⅔% to 20%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100 amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5%
$10 to $25 list	11%
$25 to $50 list	14%
	Low Grade
Less than $10 list	5%
$10 to $25 list	16%
$15 to $50 list	24%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 5%
$10 to $25 list	+10% to 11%
$25 to $50 list	+14% to 14%
	Low Grade
Less than $10 list	5%
$10 to $25 list	16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+ 10%
1/5 to std. pkg.	5% to 8%
Std. pkg.	23% to 25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to 10%
1/5 to std. pkg.	list to 20%
Std. pkg.	25% to 28%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List to 40%	5% to 30%
$2.00 to $10.00 list	10% to 56%	5% to 40%
$10.00 to $50.00 list	20% to 64%	10% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

Listfprice	$6.00
Discount	30%

CHICAGO

List price	$5.50 to $6.00
Discount	30%

WIRE ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.4340 to $0.4625
No. 18, full spools	.3840 to .4425

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.65 to $0.69
No. 18, full spools	55 to .575

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00–$20.00	$12.00–$15.00	$10.50–$11.25
12	23.22– 27.10	21.29– 23.20	17.05– 17.42
10	29.70– 37.80	27.00– 32.40	23.75– 24.80
8	41.91– 53.35	38.10– 45.70	32.58– 33.55
6	60.33– 84.40	54.27– 72.35	51.56– 53.05

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$19.00–$21.00	$14.00–$16.00	$12.50–$13.25
12	27.53– 28.70	23.86– 28.70	22.02– 24.50
10	33.02– 40.10	30.48– 40.10	27.44– 34.23
8	46.09– 56.50	42.54– 48.23	38.99– 41.34
6	61.30– 91.18	61.76– 77.84	52.18– 66.72

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$35.10 to $38.40
25 to 50 lb.	35.10 to 36.40
50 to 100 lb.	32.40 to 34.10

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$37.00 to $39.72
25 to 50 lb.	36.00 to 38.72
50 to 100 lb.	35.00 to 37.72

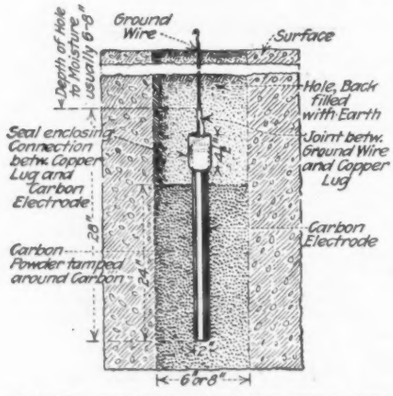
NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Carbon Ground Cones

Carbon earth-ground cones are being manufactured by the Burn-Boston Battery & Manufacturing Company, 134 State Street, Boston, which, the manufacturers claim, will assure continuous service during lightning and surging in so far as the earth grounds are concerned. These cones are made entirely of carbon and have no metal in contact with the earth, thus eliminating the corrosion that usually occurs with copper grounds and the rusting likely with iron grounds. Carbon grounds are neutral with the earth and, according to the makers, will last indefinitely. They may be placed in any soil or may be made into a salted ground without deterioration. Being non-metallic, they have no induction and therefore do not throttle the discharge. In metals and their alloys there is an increase of resistance with temperature rise, whereas in the carbon earth grounds this disadvantage is not apparent.

It is claimed that under existing conditions iron-pipe grounds cost more installed than the first cost of the Burn-Boston ground. Copper grounds cost very much more per unit of rating. Carbon has the same contact resistance per unit surface as bright copper when first placed in the ground. The ground is also made in what is known as type LR, which is used to obtain a ground of less than 25 ohms resistance as required for low-tension 220-volt transformer secondaries.

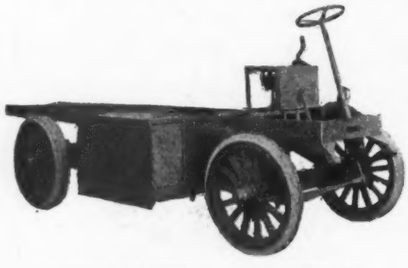

Ground Wire
Surface
Depth of Hole to Moisture usually 6'-8"
Hole, Back filled with Earth
Seal enclosing Connection betw. Copper Lug and Carbon Electrode
Joint betw. Ground Wire and Copper Lug
Carbon Electrode
Carbon Powder tamped around Carbon
24"
6" or 8"

GROUND CONNECTION THAT WILL NOT THROTTLE DISCHARGE

This type LR carbon earth ground is installed in the ordinary post hole. The construction consists of a solid electrode rod of great mechanical strength and not liable to breakage. This solid carbon rod electrode is impervious to water. The dimensions are 2 in. in diameter by 24 in. long (5.08 cm. by 1.8 m.). At the top end is a sealed-in copper connector with lug exposed for soldering to the usual No. 4 B. & S. line wire. The other end is buried in powdered carbon. This carbon rod is dropped into a post hole and the post hole is filled with Burn-Boston carbon powder, tamped around the solid electrode. A few pails of water are thrown on top of the carbon powder for the initial moistening of the carbon, or the powder may be moistened into a tamping consistency by mixing with water before filling the hole. The rest of the hole is filled with the removed earth. The carbon powder, being very hygroscopic, will remain moist.

All-Steel Electric Truck

An electric truck made all of steel excepting the wheels and which may be used instead of a gas-driven truck is being placed upon the market by the Ward Motor Vehicle Company of Mount Vernon, N. Y. The feature of

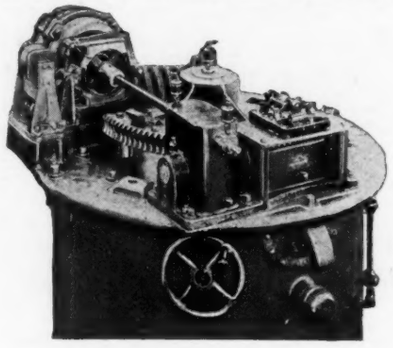


MOTOR DIRECTLY CONNECTED TO MAIN TRUCK SHAFT

this truck is that it is driven by a motor directly connected to the main shaft. The wheels are driven by the utilization of a Spicer universal drive through a worm gear on the Sheldon axle. It is equipped with Edison batteries hung on the side of the shaft as shown in the accompanying illustration. The motor and electric controller are made by the General Electric Company, Schenectady, N. Y.

Large Polyphase Induction Regulators

The mammoth polyphase induction regulator which has just been completed for the Hartford (Conn.) Electric Light & Power Company is rated at 1000 kva. and provides 10 per cent regulation on a 10,000-kva., 11,000-volt, three-phase, 526-amp. transmission line. The regulator, which is manufactured by the General Electric Company of Schenectady, N. Y., is an oil-immersed, forced oil-cooled type which is said to give good service. In this method of cooling the cold air is forced in at the bottom of the regulator to the lower portion of the windings, which extend below the core and which are



TOP VIEW OF THREE-PHASE OIL-IMMERSED FORCED 1000-KVA. REGULATOR

especially spaced so as to give free passage of the oil. As the oil passes upward it is forced through three separate and distinct passages, each passage being of such size as to allow a flow of oil in proportion to the heat generated. One oil passage is inside the rotor iron along the rotor, one outside the stator iron between the regulator and the tank, and the third through the gap between the shunt and series windings. After passing through the upper portion of the windings, which are spaced in the same manner as the lower portion, the oil overflows into a channel along the inside of the tank. In order that the flow in the channel be uniform from all directions a special distributor is provided. From the channel the oil is conducted by gravity through a series of cooling coils to a storage tank and from the storage tank is again forced through the regulator. The strand insulation of the shunt winding is exceptionally strong and additional insulation is used between layers. The series coils are of one turn per layer, and the turns are insulated from each other with insulation which will withstand a potential greater than the full-line voltage.

In order to allow a free passage of the oil through the coil insulation into the coil, each coil is provided with a vent at the bottom. In addition, the complete machine is given a vacuum oil treatment to remove any air pockets that may exist in the coils. The parts of the coils which extend above and below the core are provided with mechanical reinforcing to withstand the strains due to short circuits. The shunt coils are banded to an iron support,

and around the series coils is placed a heavy iron ring, properly insulated, to which each coil is corded securely. The regulator is motor-operated and will travel from one limit to the other limit in forty seconds. The dimensions of the regulator are 4 ft. 6 in. (1.4 m.) at the base with a height over all of 10 ft. 3½ in. (3.1 m.), and the weight is approximately 23,000 lb. (10,432 kg.).

Lock-Socket Reflector

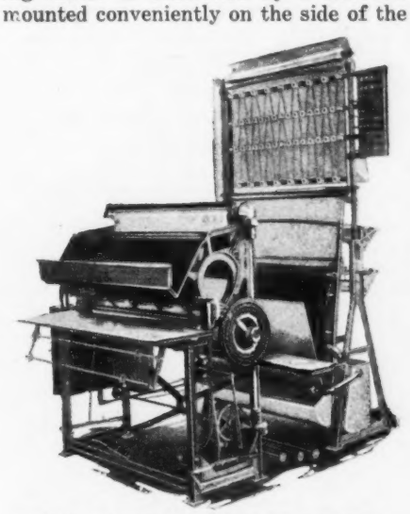
In order to insure continuous service for lamps illuminating signboards the A. & W. Electric Sign Company, Cleveland, Ohio, has placed upon the market

PREVENTS LAMPS FROM GETTING LOOSE IN SOCKET

a lock-socket reflector which will prevent the lamps from being stolen. This device, shown herewith, in addition to eliminating loss of lamps by theft, also prevents them from getting loose in sockets. The lock socket is made by Pass & Seymour, Inc., Solvay, N. Y.

Electrical Blue-Printing Machine

The maxim "Do it electrically" is worked to the limit in the blue-printing machine marketed by the C. F. Pease Company, 213 Institute Place, Chicago. As shown in the illustration, the driving motor is controlled by a rheostat mounted conveniently on the side of the



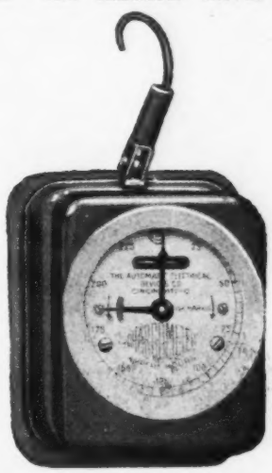
BLUE-PRINTS ARE DRIVEN, PRINTED, WASHED AND DRIED ELECTRICALLY

machine. The manufacturers state that blue-print speeds of 4 in. (10 cm.) to 6 ft. (1.8 m.) per minute are obtained when the machine is driven by a 220-volt alternating-current motor. Five arc lamps are used for printing and are independently controlled. The drying unit, shown above the washer, requires about 50 amp. at 230 volts when the printer is running at maximum speed. It consists of an electric heater furnished with a series of switches giving eleven gradations of heat.

When the machine is equipped for direct current it is possible to place the resistance coils of the lamps in the electric heater, thereby decreasing by about one-third the amount of energy consumed in drying.

Meter That Indicates State of Battery Charge

An electric ampere-hour meter known as a "chargometer," which is designed for use on trucks or storage-battery cars to enable the operator to see at a glance the extent to which the battery has been discharged, is shown in the illustration reproduced herewith. The meter is calibrated in ampere-hours indicating zero when the battery is fully charged. The indicator moves in a



CHARGING CIRCUIT IS OPENED WHEN POINTER REACHES ZERO

clockwise direction as the battery is discharged.

In order to charge the battery a flexible lead and clip connected to a charging set are joined at the top of the chargometer, as shown, and as the charging operation continues the pointer moves back toward zero.

The "chargometer," together with various panels to be used at the charging stations, is made by the Automatic Electric Devices Company, 120 Opera Place, Cincinnati, Ohio.

Metal Strips to Support Switch Boxes

To eliminate the old trouble-making and time-losing way of supporting switch boxes on wooden strips a type of metal-supporting strip has been developed. It is being sold by the Ohio Distributing Company of Chicago. The strips are made of sheet metal and are ⅝ in. (1.6 cm.) wide and 18 in. (45 cm.) long. The following advantages are claimed for these strips: They are provided with lath holders, they have indents which catch the ears of the switch box and prevent it from moving along the strip, they can be cut with pliers, they allow the switch box to be installed without reversing the ears, and they save time in mounting switch boxes.

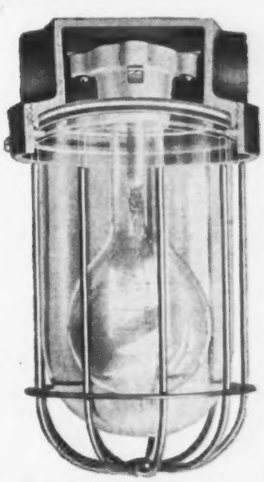
Vapor-Proof Fitting

Heretofore it has been difficult to obtain a reliable seal in vapor-proof fittings using threaded glass globes because of difference of expansion in the glass and metal base. In the Dennison fitting recently brought out by the Dennison Electric Fitting Company of New York this trouble is avoided because the seal is obtained by using a blown-glass globe having an extended flange clamped between gaskets. The clamping is permitted by a threaded ring engaging with the base of the fitting.

Instead of having a sealing surface of only the thickness of the glass wall, this seal is obtained between the two flat surfaces, to which great pressure can be applied with the assurance that it will be impossible for the seal to loosen or the glass to break with expansion.

The ring or collar may be used as a holder for a reflector or for a guard. The wiring space afforded in the base is ample for all splices, and the socket is so made that all the wiring can be done from the outside It is not necessary to take the socket holder, etc., apart when connecting. This feature alone is a great time saver.

Being blown instead of cast, the glass will allow a great temperature variation without cracking, as in the case where water or a spray will strike the glass heated by a lighted lamp. The fitting is particularly adapted to service where economy of space and ruggedness is demanded and is made



SEALING IS OBTAINED BETWEEN TWO FLAT SURFACES

for lamps rated at 25 watts to 200 watts and all standard pipe connections.

The fitting is handled exclusively by Frank E. Watts, 30 Church Street, New York City.

Trade Notes

Government Contracts

The departments at Washington, D. C., during the past few weeks have awarded the following contracts:

ORDNANCE DEPARTMENT—Wagner Electric Manufacturing Company, National Electrical Supply Company, Westinghouse Electric & Manufacturing Company.

ARMY MEDICAL CORPS—Victor Electrical Corporation, X-ray material; National Electrical Supply Company, flashlight lamps; Domestic Electric Company, X-ray apparatus; General Electric Company, X-ray supplies.

MARINE CORPS, NAVY DEPARTMENT—Westinghouse Electric & Manufacturing Company, 0.1-kw. turbo-generator, electric supplies; Novelty Electric Company, tape; Frank H. Stewart Electrical Company, electrical supplies; Walker & Keppler, electrical supplies; Jones-Beach Company, electrical supplies.

BUREAU OF SUPPLIES, NAVY DEPARTMENT—Weston Electrical Instrument Company, ammeters and voltmeters; Western Electric Company, testing set, electrical supplies, telephone equipment, wire; National Metal Molding Company, electric wire; Sprague Electric Works of the General Electric Company, electric wire, cable, steel conduit, spare parts for motors; Columbia Metal Hose Company, electric wire; Eastern Tube & Tool Company, electric wire; Youngstown Sheet & Tube Company, electric wire; Bailey Electric Supply Company, electric supplies; John A. Roebling's Sons Company, strands, wire; Economy Fuse & Manufacturing Company, fuses; F. H. Lovell & Company, sockets; Manning, Maxwell & Moore, engineering lathes; Illinois Wire & Cable Company, wire; General Electric Company, electrical supplies, blower; Wetmore Savage Company, electrical supplies; Standard Underground Cable Company, cable wire.

GENERAL ENGINEERING DEPOT—Cutler-Hammer Manufacturing Company, motor starters, fuses, rheostats, spare parts for controllers, etc.; General Electric Company, rheostats, air chute, "mazda" lamps, spare parts for generating sets and searchlamps, insulated cable parts for gas-electric sets, projectors and parts, projector switches and magnetos; Carroll Electric Company, switch arrows, buzzers, rubber cement, rubber tape, exhaust fans; Bodine Electric Company, motors; Conduit Electrical Manufacturing Company, electrical supplies; National Electric Light Company, electrical tests; Northwestern Manufacturing Company, motor spare parts; Page Steel & Wire Company, steel wire weaving; Rome Wire Company, copper wire; Smith & Hemenway Company, lineman's climbers; Westinghouse Electric & Manufacturing Company, spare parts for motors and searchlights; Worcester Electric Manufacturing Company, switchboard frames; Crocker-Wheeler Company, motor spare parts; Peerless Electric Company, motor spare parts; Edison Storage Battery Company, batteries; H. W. Johns-Manville Company, asbestos sheets, packing; Ingersoll-Rand Company, hoists, compressors and parts; Driver-Harris Company, wire; Imperial Electric Company, motors; Chicago Pneumatic Tool Company, wood covers, hammers; National Carbon Company, carbons and containers; American Steel & Wire Company, steel hoisting rope; J. G. Brill Company, seats for limber and caisson wagons.

CHARLES F. TOWN, formerly connected with the Brooklyn Union Gas Company, has resigned to take the position of general manager of the Bailey Reflector Company of Pittsburgh, Pa.

MONKS & JOHNSON of Boston, Mass. architects and engineers, have established a branch office at 1825 Wylie Street, Philadelphia, and request the trade to send them catalogs at that address.

A. V. LARSON, formerly with the American Engineering Company, in Pittsburgh and Philadelphia territory, is now in the employ of the L. E. Pollard Company, Inc., of Minneapolis, Minn., as sales manager.

THE TAISHO TRADING COMPANY, LTD., a Japanese corporation, has acquired the business heretofore carried on by Kenjiro Kurasawa under the name of the Taisho Trading Company of New York City. Mr. Kurasawa remains with the new company as president, and Kitaro Kato has been made resident manager.

W. H. CALLAN, general manager of plants, and W. P. Pressinger, general manager of sales, have been elected vice-presidents of the Chicago Pneumatic Tool Company of Chicago.

J. R. PALMER, who had charge of the line material sales of the Ohio Brass Company of Mansfield, Ohio, for a number of years, is now in Philadelphia, where he will be engaged in naval airplane production work.

A. NIEDERMEYER, for many years connected with the Worthington Pump & Machinery Corporation, most recently as works manager of the Snow-Holly Works of that company at Buffalo, N. Y., resigned on May 31 to devote his entire time to enterprises of his own.

D. C. GROVE, formerly advertising manager of the Diehl Manufacturing Company of New York City, manufacturer of electrical machinery, is now in the same department of the Ingersoll-Rand company, manufacturer of air compressors.

THE COMMERCIAL RESEARCH COMPANY, metal specialist for incandescent lamps, has sent out notices that after July 1 its executive and sales offices will be removed from Long Island City, N. Y., to 18 East Forty-first Street, New York City.

THE UNITED STATES TARIFF COMMISSION OF WASHINGTON, D. C., has published an outline of its work and plans in pamphlet form, as detailed in the address of F. W. Taussig, chairman, delivered before the Home Market Club of Boston, Mass.

H. W. WATTS has been transferred from Boston to become manager of the Diehl Manufacturing Company, manufacturer of electrical apparatus, in New York City. In fact, Mr. Watts is the manager of both offices. He was at one time connected with the company's selling staff in New York for five years.

THE FRED FULLERTON COMPANY, INC., has taken over the New York business of the Fullerton Electric Company, formerly at 109 West Twenty-sixth Street and now removed to Scranton, Pa. A general jobbing trade is carried on by the Fred Fullerton Company, Inc., which is located at 21 and 23 East Twenty-second Street, New York.

J. W. MAHONEY has just severed his relations with the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., to begin practice as a consulting mechanical and electrical engineer in New York City. Mr. Mahoney will specialize in industrial and power electrical control and switching equipment. Until further notice his address will be 574 Eighty-first Street, Brooklyn, N. Y.

JOHN G. WOOD of Anderson, Ind., formerly general manager of the Remy electric division of the United Motors Corporation, has been appointed president and general manager of the Mid-West Engine Company, a consolidation of the Lyons-Atlas Engine Company of Indianapolis and the Hill Pump Company of Anderson, Ind. The new company will specialize in turbine engines.

NORWEGIAN CABLE AND RUBBER PLANT.—At Christiania, Norway, has just been finished the first Norwegian cable and rubber goods factory. It will specialize in the manufacture of all kinds of wire cable and other products. The plant covers an area of about 8000 square meters in addition to space allotted for buildings for electrical transformers and other equipment. The cost of the plant entire is placed at $402,000.

THE GENERAL ELECTRIC COMPANY of Buffalo, N. Y., will build a new local plant on property recently acquired at East Ferry Street and Fillmore Avenue, about 195 ft. by 415 ft., to be devoted to the production of incandescent lamps. The first unit will be of brick and steel construction, the entire plant to have a capacity of about 90,000 lamps per day. The company is making rapid progress in the erection of a new two-story addition, about 45 ft. by 65 ft., to building No. 31, at Schenectady, N. Y. Improvements are also being made in this structure.

THE NATIONAL WAR LABOR BOARD of Washington, D. C., has ruled that individual employment contracts be abolished at Pittsfield, Mass., in the plant of the General Electric Company, employing about 7000 men. Former President William H. Taft and Frank P. Walsh, joint chairmen, were appointed to "establish a just system of collective bargaining between the company and the men." It is understood that the board will establish a system of elections by which the workers may choose committees to represent them in dealing with the company.

THE WESTINGHOUSE LAMP COMPANY of New York City has leased property at 536-546 West Twenty-third Street, which will be used for extensions.

M. KEITH DUNHAM, formerly consulting engineer of New York City, is engineer in charge of apparatus for the Bastian-Blessing Company, manufacturer of apparatus for welding and cutting, of Chicago, Ill.

D. C. GOULD, who has been connected with the Willard Storage Battery Company for a number of years as district manager of the Chicago territory, has been transferred to Indianapolis, Ind., and made manager of the company's branch there.

HOWARD F. VIOT, for the past ten years manager of the Omaha district of the Shelby lamp division, National Lamp Works, has recently been promoted to the management of the Chicago district for the company, with headquarters at 730 South Michigan Avenue.

THE BABCOCK & WILCOX COMPANY of Bayonne, N. J., manufacturer of boilers, etc., has commenced operations in a large new addition to its plant recently completed. The structure, which with its new equipment is estimated to cost $1,500,000, is about 150 ft. by 330 ft.

THE INDUSTRIAL ELECTRIC FURNACE COMPANY of Chicago, has installed two single-phase Snyder electric furnaces, to be operated together on a polyphase current system, at the plant of the Western Steel Car & Foundry Company of Chicago. These two furnaces, are each 1½ tons capacity. They are designed for acid operation on steel castings.

THE HAMILTON-BEACH MANUFACTURING COMPANY of Racine, Wis., reports that it is 40,000 small motors behind. In its present plant it is producing 25,000 small motors per month. Sixteen salesmen of the company have been put on vacation for two months with full pay. The factory rooms which were formerly used as storerooms, are now filled with machinery used in production. The company is also engaged in building a 50-ft. by 150-ft., three-story addition to its factory in the hope of bringing production up to demand.

THE SANGAMO ELECTRIC COMPANY of Springfield, Ill., sent out a shipment of 75,000 lb. of meters one week in June consigned for redistribution in this country and abroad. Most of the meters will see "overseas service." Of interest because of the wide distribution are the foreign shipments. Six hundred meters are bound for Barcelona, Spain; 500 are to be sent to the government plant at Montevideo, Uruguay; 500 will be used by an electric light company in Lima, Peru; nearly 1000 have for their destination Melbourne, Australia; 300 go to Durbin, South Africa, for distribution to other points in South Africa, and there also are included in the lot shipments for Cuba and for Christiania, Norway. In addition to this, the Sangamo company recently sent allotments to Bangkok, Siam, and New Zealand. Every month regular shipments are sent to the company's assembling and testing plant at Osaka, Japan, from where meters are distributed through Japan and China.

Trade Publications

FLASHLAMP.—The Import Sales Company, 33 West Twentieth Street, New York City, has issued a bulletin illustrating and describing its flashlamp and electric trench mirror.

MOTOR-GENERATOR SETS.—In bulletin 33, issued by the Perfection Storage Battery Company, Fortieth Street and Rhodes Avenue, Chicago, may be found descriptions of battery-charging sets manufactured by that company.

PIPE-BENDING MACHINES.—Machines for bending metal pipes, tubes and rods of various sizes are described in a bulletin entitled "'Wonder' Pipe Benders," distributed by the American Pipe Bending Machine Company, 37 Pearl Street, Boston.

PROFITABLE EMPLOYMENT WITH PLEASANT SURROUNDINGS.—This is the title of a booklet that has been issued by the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia. This booklet is published for the purpose of giving information regarding employee conditions at this plant, and it says that this company offers opportunities for employment to boys, girls, young men, young women and high-grade mechanics and toolmakers. It tells about the business and the opportunities for the betterment of positions of employees.

DRAFTING-ROOM EQUIPMENT.—Electric blue-printing machines, drafting-room equipment and surveying instruments are described and illustrated in catalog B, issued by C. F. Pease Company, 213 Institute Place, Chicago. The book contains 265 pages of descriptive matter and is bound in heavy cardboard.

ELECTRICAL EQUIPMENT FOR GARMENT MANUFACTURERS.—This is a title of a bulletin that has recently been issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It is known as Motor Application Circular 7150, and tells of the complete line of electrical apparatus for garment manufacturers that this company makes, which includes motors for power tables and individual sewing machines, electric pressing irons, electric lamps, electric fans and electric ventilating fans.

New Incorporations

THE AMERICAN POWER & RAILWAY COMPANY of Charlotte, N. C., has been chartered with a capital stock of $100,000 by H. M. Victor, C. B. Bryant and D. D. Traywick.

THE VICTORY BATTERY COMPANY of New York, N. Y., has been chartered with a capital stock of $20,000 by C. Kreiger, M. Wilkenfield and J. Berman, 996 Home Street.

THE SACRAMENTO (CAL.) ELECTRIC VEHICLE COMPANY has been incorporated for the purpose of taking over the electric vehicle department of the James F. Pepper Company.

THE REPUBLIC (MO.) LIGHTING & POWER COMPANY has been incorporated with a capital stock of $5,000 by G. W. Thurman, Manerva Chaffin and H. L. Pemeyor, all of Republic.

THE MODERN ELECTRIC COMPANY of Erie, Pa., has been chartered with a capital stock of $5,000 by K. E. Tederous, Abdo M. LeAsner of Erie, and D. E. Tederous and K. Tederous of Dunkirk, N. Y.

THE R. H. MILTON ELECTRIC COMPANY, of Greensboro, N. C., has been incorporated with a capital stock of $25,000 by S. R. Morrison, S. G. Milton and L. V. Milton. The company proposes to do a general electric business.

THE WILBUR B. DRIVER COMPANY of Belleville, N. J., has been chartered with a capital stock of $500,000 to manufacture wire rope, cables, etc. The incorporators are Irving Eisenberg, Evelyn T. Adam and Irving T. Vanderbilt, Newark.

THE ELECTRIC WELDING COMPANY of Newport News, Va., has been incorporated with a capital stock of $50,000. The officers are: William Schenstrom, president; Charles H. Peoples, secretary, both of Brooklyn, N. Y., and K. B. Johnson of Norfolk, Va., treasurer.

THE L. S. BRACH SUPPLY COMPANY, 127 Sussex Avenue, N. J., has been incorporated with a capital stock of $200,000 to manufacture and sell electrical devices, railway signals and insulating specialties. The incorporators are Leon S. Brach, Alexander G. Brach and Rebecca Tuchman.

THE DERF MANUFACTURING COMPANY of New York, N. Y., has been incorporated by W. B. Noble, 1089 Prospect Place, Brooklyn, and F. L. Hartt, 300 West 141st Street, New York City. The company is capitalized at $100,000 and proposes to manufacture spark plugs, motor engines, etc.

THE INTERNATIONAL MARINE COMPANY of New York, N. Y., has been incorporated by C. R. Stewart, N. Murphy of Ridgewood, N. J., and R. T. Anderson of Greenwood Lake, N. J. The company is capitalized at $100,000 and proposes to do a general marine, mechanical and electrical engineering business.

THE AUTOMATIC BATTERY CORPORATION of Boston, Mass., has been incorporated with a capital stock of $25,000 to manufacture and deal in electric batteries. The incorporators are: James Mackenzie of Boston, Mass.; G. M. Washburn of Providence, R. I., and C. W. Dunbar of Holyoke, Mass.

THE TELEGRAPHONE MANUFACTURING COMPANY of Kittery, Me., has been incorporated by Charles S. Ballard of Springfield, Mass.; Aaron B. Cole, L. B. Cole, Ralph E. Clark and M. E. Anderson of Kittery. The company is capitalized at $500,000 and proposes to manufacture and deal in mechanical and electrical devices.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

BIDDEFORD, ME.—The Clark Power Company has petitioned for permission to erect an electric transmission line from Union Falls to Biddeford to supply electricity to the Pepperell Mills.

DOVER, N. H.—Extensive improvements are being made by the Twin State Gas & Electric Company, which will involve an expenditure of about $60,000. A direct line has been erected between Dover and the power station at South Berwick. A new substation has been erected at South Berwick and two new transformers are being installed. Arrangements have been made with the Rockingham Light & Power Company whereby an exchange of power between the two companies has been agreed upon.

BURLINGTON, VT.—Plans are being prepared by the E. B. & A. C. Whiting Company for the construction of a new power plant, 50 ft. by 50 ft., at its works.

BOSTON, MASS.—Plans have been prepared by the Boston & Maine Railroad Company, North Station, for extensions and improvements in its power house near Lawrence, to cost approximately $14,000.

BOSTON, MASS.—Bids will be received by the Commission on Mental Diseases, State House, Boston, until July 22 for construction of an addition to hospital in Mattapan District, to cost about $385,000. The plans include equipment for building. Kendall Taylor & Company, 93 Federal Street, are architects.

DALTON, MASS.—The local substation of the Pittsfield Electric Company was damaged by fire recently, causing a loss of about $2400.

FALL RIVER, MASS.—Arrangements are being made by the Water Board for the erection of an auxiliary water-pumping station equipped with a motor-driven centrifugal pump of 8,000,000-gal. capacity.

FALL RIVER, MASS.—The Executive Council has approved the petition of the Fall River Electric Light Company for permission to erect and maintain electric transmission lines over Warren and Coles Rivers, between Swansea and Somerset.

IPSWICH, MASS.—A special town meeting has been called to take action on the question of purchasing electricity from the Newburyport Gas & Electric Company instead of generating it at the municipal plant.

LAKEVILLE, MASS.—A new power plant will be erected at the Lakeville State Sanitarium in connection with the construction of a new laundry building at that institution. The cost of that work is estimated at about $15,000. Curtis Bixby, 8 Beacon Street, Boston, is architect.

LENOX, MASS.—A fund has been given by Andrew Carnegie for a new electric lighting system for the Lenox Library.

NEWBURYPORT, MASS.—The Newbury Gas & Electric Company is reported to have acquired 500 ft. of water frontage on the Merrimack River, on which it proposes to erect a large central power plant of sufficient output to supply electricity for lamps and motors for industries within a radius of approximately 25 miles. The cost of the proposed plant is estimated at $10,000,000.

NORTH ADAMS, MASS.—Preliminary work has begun on the construction of an addition to the boiler house, 40 ft. by 55 ft., of the North Adams Gas Company.

NORTH DANA, MASS.—The Gardner (Mass.) Electric Light Company has submitted a proposal to the Board of Trade to supply electricity in Dana, under the terms of which it will deliver energy at Petersham. This would require the erection of an electric transmission line 6 miles long, if erected direct to North Dana, or 9 miles by the way of Dana Center, either by the town or local interests.

SOMERSET, MASS.—Arrangements have been completed by the Shipping Board, Washington, D. C., for the construction of a shipbuilding plant at Somerset to be operated by the Crowningshield Shipping Company, South Somerset. It will cost approximately $250,000 and will include large machine and erection shops. Contract has been awarded to the Aberthaw Construction Company of Boston.

HARTFORD, CONN.—The Spencer Turbine Company is reported to be asking for bids for a new factory, 77 ft. by 300 ft., one story, with two-story section, 40 ft. by 77 ft., to be erected on New Park Avenue. The Spencer company was recently merged with the Organ Power Company.

NEW HAVEN, CONN.—The government, it is understood, will assist the Connecticut Light & Power Company to secure material and labor to complete its proposed hydroelectric generating plant on the Housatonic River at Stevenson. Surveys are being made for the erection of a high-tension transmission line from the plant at Stevenson to Bunker Hill, where a substation will be erected, and the power lines connected with the Bull's Bridge line. The plans provide for an initial installation of 20,000 kw. The cost is estimated from $3,000,000 to $4,000,000. Charles L. Campbell is secretary and treasurer of the company.

Middle Atlantic States

BROOKLYN, N. Y.—The Standard Oil Company, 26 Broadway, New York City, is planning to erect a new pumping plant, 40 ft. by 70 ft., at its local plant. The cost of the plant, which will be electrically operated, is estimated at about $10,000.

BUFFALO, N. Y.—A one-story power house, 40 ft. by 85 ft., will be erected by the Ferguson Steel & Iron Company, 1499 Bailey Avenue, in connection with the construction of its new shipbuilding works on Abbott Road.

BUFFALO, N. Y.—The application of the City Commission for permission to issue $120,000 in bonds to provide funds for the installation of a new flashlight signal system in the water-front section has been denied by the Capital Issues Committee at Washington.

BUFFALO, N. Y.—Contract has been awarded by the Ferguson Steel & Iron Company, 1399 Bailey Avenue, to the J. W. Cowper Company, Fidelity Building, Buffalo, for the erection of its shipbuilding works on Abott Road, which will include a one-story machine and shipworks building, 40 ft. by 105 ft.; a four-story assembling shop, 120 ft. by 400 ft.; one-story mold works, 50 ft. by 200 ft.; electric power plant, 40 ft. by 82 ft. and office building, 40 ft. by 105 ft.

BUFFALO, N. Y.—To meet the demand for additional power for war industries in this section extensive additions are being made to the steam generating plants of the Buffalo General Electric Company and the Niagara, Lockport & Ontario Power Company, aggregating 62,000 hp. By means of a further development the American hydropower companies at Niagara Falls will increase their output by about 160,000 hp. The present capacity of the plants at Niagara Falls is about 250,000 hp.

COHOES, N. Y.—The Cohoes Company and the Cohoes Gas Company have petitioned the Public Service Commission for permission to transfer their plants and holdings to the Cohoes Power & Light Corporation, recently organized. The new company is capitalized at $5,000,000. The company also asks for permission to issue $2,500,000 in bonds and the same amount in capital stock, part of which will be used for extensions and improvements.

ELLIS ISLAND, N. Y. H., N. Y.—Bids will be received at the office of the United States Commissioner of Immigration, Ellis Island, New York Harbor, until July 22, for furnishing and installing a new boiler feed pump in main power house at the United States Immigration Station at Ellis Island.

LONG ISLAND CITY, N. Y.—The War Department, Cantonment Division, Washington, D. C., is planning to erect a gas defense plant in Long Island City, to cost about $88,500.

NEW YORK, N. Y.—The Bureau of Yards and Docks, Navy Department, Washington, contemplates the purchase of electrically driven capstans for the New York Navy Yard, specification No. 3172, to cost about $21,000.

NEW YORK, N. Y.—Plans have been prepared by the New York Steam Company, 280 Madison Avenue, for improvements and extensions in the coal-handling system at its steam generating plant on East Fifty-ninth Street, to cost about $12,000.

NEW YORK, N. Y.—Arrangements have been made by the Western Union Telegraph Company for the erection of a six-story building at 38 and 40 Broad Street to be used as its principal operating terminal and commercial office. It is proposed to move the cable terminals from the present offices to the new building as soon as it is ready for occupancy. The facilities for handling the cable business will be greatly improved.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., July 22, for furnishing and installing an electric power system in the structural shop at the navy yard, New York, N. Y. Drawings and specification No. 3131 may be obtained upon application to the above bureau or to the commandant of the navy yard named, upon deposit of $10.

SYRACUSE, N. Y.—The Semet-Solvay Company, Milton Avenue, is planning to rebuild its works, recently destroyed by an explosion. The proposed work will include three T. N. T. plants, one nitric-acid plant, laboratory, boiler house and office.

CAMDEN, N. J.—The City Council has authorized an issue of $15,000 in bonds for the installation of a new fire-alarm system.

ELIZABETH, N. J.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a new naval air station with shop buildings at Elizabeth, N. J., to cost about $300,000.

KEASBEY, N. J.—The local substation of the Public Service Company was destroyed by fire on July 6. The plant, it is understood, will be rebuilt at once.

MONTCLAIR, N. J.—Contract has been awarded by the City Commission to the Public Service Corporation for alterations and improvements to the overhead lines of the fire-alarm system in the North End section.

NEW BRUNSWICK, N. J.—Plans are being considered by the Board of Freeholders for the construction of a new electrically operated drawbridge over the Delaware and Raritan Canal. Application has been made to the Capital Issues Committee for approval of a bond issue for $80,000 for the work.

POMPTON LAKES, N. J.—In connection with the proposed addition to the municipal electric light plant a bond issue of $46,000 has been approved recently, and an additional appropriation of $10,000 has been provided by the Borough Council. All bids received for the proposed work have been rejected by the Council, and new bids will be asked for at an early date.

PHILADELPHIA, PA.—The Philadelphia & Reading Railroad Company is planning to erect a power plant at its works at Tulip and Somerset Streets, to cost about $30,000.

PHILADELPHIA, PA.—Plans have been filed by the Hulton Printing, Processing & Dyeing Company, 3851 Frankford Avenue, for alterations and improvements in its power house on Coral Street.

PHILADELPHIA, PA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to purchase air compressors, to cost about $75,000 (specification No. 3173); electrically driven capstans, to cost about $21,000, (specification No. 3172), for the Navy Yard at Philadelphia, and to install two electrically operated cranes in air-craft factory, to cost about $30,000 (specification No. 3202).

PITTSBURGH, PA.—Plans are under consideration by the Standard Underground Cable Company for the construction of a one-story addition, 60 ft. by 100 ft., to its plant, to cost about $10,000.

WILKES-BARRE, PA.—The City Council has passed on first reading an ordinance to grant the Wilkes-Barre Company (the old company) the lighting contract. The Wilkes-Barre Light Company, the new concern, was awarded the contract two years ago. Six months were allowed the company to prepare for the service; the time was extended and the company was unable to fulfill its contract.

ANNAPOLIS, MD.—The Navy Department, Washington, D. C., is contemplating the construction of an electric power plant at Annapolis, to cost about $320,000.

BALTIMORE, MD.—Contracts, it is understood, will soon be awarded by the American Can Company, Maryland Trust Building, for the construction of a building, 105 ft. by 176 ft., four stories, on Boston and Hudson Streets, Canton, to cost between $150,000 and $180,000. N. M. Loney, 120 Broadway, New York, N. Y., is architect.

ST. HELENA, MD.—Plans are being prepared by Smith & May, 1133 Calvert Building, Baltimore, for the erection of a public school building, to cost approximately $300,000, for the United States Shipping Board. J. Rogers Flannery, 1319 F Street, N. W., Washington, D. C., is director of housing.

SPARROWS POINT, MD.—Contract has been awarded by the Bethlehem Steel Company, acting as agent for the United States Building Corporation, to the A. Burlingame Company, 22 Cypress Street, Worcester, Mass., for furnishing power plant and power piping work for the addition to the Sparrows Point shipbuilding plant.

KEYSER, W. VA.—The Baltimore & Ohio Railroad Company is reported to be considering extensions and improvements to its local car and locomotive works.

NORFOLK, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to purchase electrically driven capstans for the navy yard at Norfolk, to cost about $21,000 (specification No. 3172).

North Central States

CASSOPOLIS, MICH.—Plans are under consideration by the Village Council for improvements to the water-works system, including the erection of an 80,000-gal. steel tank, two motor-driven centrifugal pumps, one 350-gal. and one 750-gal. capacity, and chlorinating apparatus. Holland, Ackerman & Holland, 122 Fourth Avenue, Ann Arbor, are engineers.

HASTINGS, MICH.—Improvements are being made to the local plant of the Thornapple Gas & Electric Company, including the installation of a 625-hp. turbine wheel. The company is building a large cement flume to replace the wooden structure carried away by flood at its dam across the Thornapple River at La Barge. The company is controlled by the J. G. White Management Corporation, 43 Exchange Place, New York, N. Y.

LANSING, MICH.—Plans are being prepared by the Michigan Power Company for the installation of a 6200-kw. turbine engine, new boilers and rebuilding its distribution system, which will increase its capacity by 200 per cent. David R. Thomas has been appointed receiver.

ST. JOHNS, MICH.—Plans are being considered for the installation of a new electric generating unit in the municipal electric light plant.

WYANDOTTE, MICH.—The Austin Company of Cleveland, Ohio, has been awarded contract by the Detroit Shipbuilding Company for the construction of a power house, 40 ft. by 100 ft.

BRYAN, OHIO.—At an election held recently the proposal to enlarge the municipal electric light and power plant was carried.

CINCINNATI, OHIO.—The contract for the installation of electric lighting fixtures in the new Hamilton County court house at Cincinnati has been awarded to Edward F. Caldwell & Company, 38 West Fifteenth Street, New York, N. Y., at $56,770. The Caldwell Company agrees to complete the work within 135 days.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until July 25 for transformers for the division of light and heat. Specifications may be obtained on application to the office of the division of light and heat.

COLUMBUS, OHIO.—Contract has been awarded by the Toledo & Ohio Central Railroad Company to the Austin Company of Cleveland for the construction of a twenty-stall roundhouse, machine shop, boiler house, oilhouse, etc., at its West Columbus yards. The cost is estimated at $250,000.

COLUMBUS, OHIO.—The Columbus Railway, Power & Light Company has applied to the Ohio Public Utilities Commission for permission to sell $3,000,000 in notes, the proceeds to be used for extensions and improvements, some of which have been made but are still unpaid.

HAWESVILLE, KY.—Owing to the failure of the City Council and W. H. Williams, owner of the local water-works system to reach an agreement in regard to the renewal of the water franchise, which expired July 1, the water system ceased operation on that day. The electric plant of the Hawesville Electric Light, Heat & Power Company was forced to close down on account of the lack of water, and the city of Hawesville will be without electrical service until terms can be made.

MAYSVILLE, KY.—The new power station of the Maysville Power Company will soon be put into operation. The old power plant of the Maysville Gas Company will be closed down but will be held as a reserve plant. The new station will supply energy to the Maysville Gas Company and the Maysville Street Railroad & Transfer Company.

WILLARD, KY.—The Black Raven Coal Company, recently incorporated, is planning to develop 275 acres of coal land to provide for a daily output of 1200 tons of coal. It is proposed to install electrical equipment, coal-cutting machines, screens, tipple screens, etc. The company is capitalized at $100,000.

CARROLLTON, ILL.—At a meeting of the Mayors and some of the Aldermen of the cities of White Hall, Roodhouse, Greenfield, Kan., and Carrollton held recently in Carrollton to protest against the proposed advance in rates for electric service by the Central Illinois Public Service Company, a proposition to construct a central electric power plant on Apple Creek to furnish electricity to all the cities in Green County was suggested by J. T. Calloway of Greenfield. Another meeting will be held in the future to consider the proposal.

CHICAGO, ILL.—The Acme Steel Goods Company, 2834 Archer Street, is contemplating the construction of a hoop-steel rolling mill in the Calumet district, to cost about $1,000,000.

CHAMPAIGN, ILL.—Extensive improvements are contemplated by the Illinois Central Railroad Company to its buildings and yards, involving an expenditure of about $250,000. The proposed work will include a new roundhouse, four cinder pits, carpenter shop, new track, etc.

CHICAGO, ILL.—The electrification of the Chicago, Milwaukee & St. Paul Railroad between Othello, Seattle and Tacoma will proceed to completion under the government regime. An expenditure of $5,346,606 for this purpose has been approved by the Director-General of Railroads during the current year, and an additional expenditure of $2,811,035 is contemplated for 1919. It is expected to complete the work by July 1, 1919.

DECATUR, ILL.—Bids, it is reported, will soon be asked by the Comet Automobile Company for the construction of a new power station. Two new boilers of 250 hp. each will be installed.

MATTOON, ILL.—The Chuse Engine & Manufacturing Company is planning to build a new manufacturing plant, to cost about $75,000. This is the first of a series of buildings the company will erect here.

GREEN BAY, WIS.—Arrangements are being made by the Northland Lumber Company of Green Bay for rebuilding its main sawmill and steam generating plant at the mouth of the Fox River, recently damaged by fire. A large part of both the power plant and mill will have to be replaced. R. C. Green is general manager.

MILWAUKEE, WIS.—Contracts will soon be awarded by the Allen-Bradley Company, 495 Clinton Street, Milwaukee, for further extensions to its plant, to consist of an addition of three stories and basement to its original shop and a new concrete smokestack. The company manufactures electric controlling devices, rheostats, etc. A. C. Eschweiller, Goldsmith Building, is architect.

RIPON, WIS.—The Central Utilities Company, recently incorporated, will take over the local electric light and power plant, waterworks and gas systems and proposes to enlarge the systems and extend the service. The company is capitalized at $150,000. The incorporators are E. J. B. Schubring, D. E. Lonegan and A. R. Peterson.

WEST ALLIS, WIS.—The Universal Machinery Company, 784 Thirtieth Street, Milwaukee, it is reported, is ready to place contracts for engines, generators, switchboards and other equipment and machinery for its steam generating plant to be erected in connection with its new foundry and machine shop group at the foot of Sixty-fourth Avenue.

MINNEAPOLIS, MINN.—A permit has been granted the Minneapolis General Electric Company for the erection of reinforced concrete and steel power house at Twenty-ninth Avenue and the river bank, to cost about $450,000.

CLINTON, IOWA.—Plans are being prepared by the Klein Paper Company, Nineteenth Avenue, Clinton, for the erection of a new paper mill, including power plant, motors, pumping machinery, etc. The cost is estimated at about $175,000.

ELKHART, IOWA.—Bids will be received by the Mayor and Council of Elkhart until Aug. 5 for the erection of transmission line, substation and distribution system in Elkhart. E. A. Lankford of Boone, Iowa, is engineer. For details see Searchlight Section.

HUMBOLDT, IOWA.—The contract for electric wiring of the new high school has been awarded to Carstens Brothers of Ackley. The cost of the building is estimated at $110,000.

HOLDEN, MO.—Plans are being prepared by Archer & Stevens, engineers, 609 New England Building, Kansas City, Mo., for rebuilding the municipal power plant.

ABERDEEN, S. D.—Work has begun on the installation of the new street-lighting system by the Aberdeen Light & Power Company. Under the terms of the new contract the present arc lamps (83) are to be replaced with series incandescents.

MITCHELL, S. D.—At an election to be held on July 23 the proposal to issue $185,000 in bonds for improvements to the electric lighting system and water-works will be submitted to the voters.

BRONSON, KAN.—Bids will be received by W. S. Low, city clerk, Bronson, until July 22 for furnishing material and construction of an electric lighting system, including construction of substations, transformers, line material, street lamps, etc., for a complete distribution system in Bronson; also for material for transmission line and transformer stations for the proposed transmission line between Bronson and Moran. Freeman D. Martin of Fort Scott is engineer.

GALVA, KAN.—Preparations are being made for the installation of an electric lighting system in Galva, for which bids have been received. The proposed work will include the erection of an electric transmission line about 6 miles long and a distributing system, to cost about $8,648. Nathan L. Jones of Larned is engineer.

MORAN, KAN.—Plans have been approved by the Public Utilities Commission for improvements to the water-works, to cost about $10,000. The proposed plans provide for the installation of an engine and an electric generating unit.

PARSONS, KAN.—The Kansas Electric Utilities Company is installing a 1000-kva. frequency-changer set in its power station.

Southern States

CHARLOTTE, N. C.—The American Power & Railway Company of Charlotte, recently organized with a capital stock of $100,000, proposes to construct and operate electric and steam railways, and also to generate and distribute electricity for lamps and motors. The incorporators are H. M Victor, C. B. Bryant and D. D. Trawick.

MAXWELTON, GA.—The Fairview Farms, recently organized, is planning to establish a dairy farm of 275 acres and will erect barns, silos, creamery, ice factory, electric plant, etc., to cost about $35,000. Maxwelton has not a postoffice.

SOUTH JACKSONVILLE, FLA.—Bonds to the amount of $100,000 have been voted for extensions to the electric-lighting, sewer and water systems to 300 dwellings to be erected by the Emergency Fleet Corporation.

WAUCHULA, FLA.—The City Council is considering calling an election to vote on the proposal to issue $20,000 in bonds for the purchase of the electric plant of the Mauchula Light & Power Company and $4,000 for additional machinery.

KNOXVILLE, TENN.—The John G. Duncan Company of Knoxville would like to receive prices on a 100-kw., three-phase, 60-cycle, 2300-volt turbo-generator unit.

PINE BLUFF, ARK.—The Pine Bluff Company is contemplating the purchase of two 600-hp. boilers.

GARBER, OKLA.—The Garber Light & Ice Company would like prices on material and equipment for pole-line distribution system for electric plant to cost about $10,000. William Musser is president.

MIAMI, OKLA.—A committee has been appointed by the Miami Business Men's League to construct and operate an interurban railway, to be operated by electricity for other motive power, through the Miami mining districts. The cost is estimated at $650,000. Dr. W L. McWilliams, George L. Coleman and F. D. Griffith are among the members of the committee.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & Electric Company is contemplating the construction of a concrete and wood cooling tower, to cost about $72,000.

YALE, OKLA.—Bonds to the amount of $200,000 have been voted for construction of a municipal electric-light plant and improvements to the water-works system.

SAN ANTONIO, TEX.—Arrangements have been completed by the United Quartermaster Department, Washington, D. C., for the construction of a machine shop, 500 ft. by 500 ft., near San Antonio. It will cost about $1,000,000 and will be used exclusively in machine repair work for motor vehicles for the War Department.

SEQUIN, TEX.—The Guadelupe Power Company is contemplating power development of the Guadalupe River, consisting of several small plants. The present plans, it is understood, provide for a total output of 40,000 kw. The hydroelectric plant will probably not be built until after the war. W. B. Dunlap of Beaumont is president.

SOMERVILLE, TEX.—Plans have been prepared by W. J. Smith of Galveston for remodeling and erecting office building and power house for the Gulf, Colorado & Santa Fé Railway Company in Somerville. F. Merritt of Galveston is chief engineer.

WICHITA FALLS, TEX.—Contract for construction of the Northwest Texas Insane Asylum in Wichita Falls has been awarded to J. C. Deilman of San Antonio. The plans provide for an administration building, receiving wards, infirmaries, power house, etc. Funds to the amount of $385,000 are available for the work.

Pacific and Mountain States

BREMENTON, WASH.—Congress has added $1,925,000 to the appropriation for improvements to the Puget Sound Navy Yard, which include $325,000 for improvements to the central power plant, $300,000 for the purchase of additional land, and $400,000 for grading, filling and sea walls.

CAMP MEADE, WASH.—Contract has been awarded by the Cantonment Division, War Department, Washington, D. C., to Smith, Hauser & MacIsaac, Inc., 18 East Forty-first Street, New York, N. Y., for the construction of a training camp for Signal Corps, with accommodations for 11,000 men, to cost about $4,000,000. The plans include new barracks, extensions to hospitals, filtration plants, etc.

CHELAN, WASH.—The Chelan Water Power Company has petitioned the Commissioners of Chelan County for a franchise to erect a pole transmission line from Entait to Maple Creek. This line will form part of the proposed new power system to be erected at Chelan, which will furnish electricity in Wenatchee and a large portion of the upper Columbia country in Chelan County.

SEATTLE, WASH.—The municipal lighting department has recently awarded the Burton L. Stare Company a contract for a 1000-kw. motor-generator set, at $24,780.

SEATTLE, WASH.—The Todd Drydock & Construction Company, 1891 Sixteenth Avenue, S. W., is planning to erect a two-story power house and storehouse building, 100 ft. by 50 ft., to cost about $9,000.

VANCOUVER, WASH.—The contract for construction of transformer station at the foot of Washington Street has been awarded to Parker & Banfield, of Portland, Ore., at $5260. This station will be used as an auxiliary to supply electricity to operate the draw span of the bridge in case the present source of power should fail.

MARSHFIELD, ORE.—Improvements are contemplated to the naval radio station at Englewood, near Marshfield, which will include the installation of a gas engine plant to furnish electricity in case of emergency. Two high-power gas engines, motors and two 1800-gal. tanks will be installed.

PORTLAND, ORE.—Work has been started on extensions to the car-manufacturing plant of Twohy Brothers of Portland in Montaville to provide for government orders for freight cars. About $150,000 will be expended in buildings and equipment.

FRENCH GULCH, CAL.—The Hazel Creek Gold Mining Company, it is said, will not rebuild its Crystal Creek power house, recently destroyed by fire. As this plant supplied the electrical service in French Gulch, it will be necessary to make other arrangements for the town. The nearest connection that can be made with the transmission lines of the Northern California Power Company is at the Washington Mine, 2 miles distant.

FRESNO, CAL.—The State Railroad Commission has granted the San Joaquin Light & Power Corporation of Fresno permission to operate in Kern County under a franchise granted by the county.

FRESNO, CAL.—Surveys are being made by the San Joaquin Light & Power Corporation on Dinkey Creek and the north fork of Kings River preparatory to developing the water power of those streams. It is proposed to carry the waters of Dinkey Creek by a conduit to north fork of Kings River and to erect the necessary dams to increase its hydroelectric power.

LOS ANGELES, CAL.—Word has been received that the Capital Issue Committee has approved $92,000 in bonds for the proposed ornamental lighting system on Broadway, between the tunnel and Tenth Street. R. H. Manahan, city electrician, has instructed the Municipal Light and Power Bureau to purchase the glass globes and electrical equipment for the system, amounting to about $15,000. The lamp standards will be installed by the Keystone Iron Works.

LOS ANGELES, CAL.—A report on the extension of the municipal electric distributing lines into the East Seventh Street industrial district, to be served from the municipal substation near Ninth and Mateo Streets, submitted by the special committee, consisting of E. F. Scattergood, chief electrical engineer, W. B. Matthews, special counsel, and Burdett Moody, business agent, has been adopted by the Public Service Commission. Contracts made or in immediate prospect, the committee states, contemplate the substitution of municipal hydroelectric power for nearly all of such steam power, representing a total of about 4500 hp. This will make possible an annual saving of 90,000 barrels of fuel oil. The cost of installing the distributing system is estimated at about $90,000.

LOS ANGELES, CAL.—Permission has been granted Marcus Pluth of Los Angeles by the State Water Commission to use 10 second-feet of water of the east fork, middle fork, north fork, and the main stream of Snow Creek in Riverside County to generate electricity to operate a Portland cement mill and for distribution in Riverside County. The plans provide for the construction of a low concrete dam at each of the points of the diversion and a main canal, flumes and pipe line aggregating 13 miles in length. The total fall to be utilized is 1232 ft. It is estimated that 2914 hp. can be developed at a cost of about $215,000. Mr. Pluth has also been granted permission to use 20 second-ft. of water of the north and south forks of Whitewater River in Riverside and San Bernardino Counties as part of the same project.

ONTARIO, CAL.—The State Railroad Commission has granted the Ontario Power Company permission to build a hydroelectric power plant in San Antonio Canyon, taking water from San Antonio Creek. The Southern California Edison Company will contract to take all energy generated which is not absorbed by the Ontario Power Company during the first five years of the contract. After five years the Edison company will take all the energy. The cost of the plant is estimated at $64,551.

MOAB, UTAH.—The dam of the Moab Light & Power Company on Mill Creek was recently carried away by a flood. At present the city is without electrical service. The dam, it is understood, will be rebuilt at once. The dam was 50 ft. in height and was located in a narrow gorge on Mill Creek, about 2 miles above Moab.

GLENDALE, ARIZ.—More than forty electrically driven pumping plants are to be purchased and erected by the Salt River Valley Water Users' Association. These pumping plants are to be installed upon wells that will be fed by the seepage water from the canal that is fed by the large reservoir created by the Roosevelt dam. Electricity to operate the pumps will be supplied by the hydroelectric plant of the Salt River Valley Water Users' Association at the Roosevelt dam. The cost of the proposed work is estimated at about $500,000.

CLOVIS, N. M.—Bonds to the amount of $50,000 have been sold, the proceeds to be used for improvements to the municipal water and light plant.

Canada

COURTENAY, B. C.—The Dyke Sawmill Company, it is reported, is planning to rebuild its mill, recently destroyed by fire. The cost of the new plant is estimated at $250,000.

REVELSTOKE, B. C.—The concrete dam at the municipal power plant was recently carried away owing to a rise in the Illecillewalt River. Repairs will be made immediately.

WHITE ROCK, B. C.—Plans are being prepared for the installation of a municipal electric light plant, to cost about $40 000, in White Rock.

LUMSDON MILLS, QUE.—Preparations are being made by the Kipawa Fibre Company for the erection of a sulphite plant on a site south of Lake Temiskaming. The cost of the proposed plant is estimated at $5,400,000.

TORONTO, ONT.—The Alloy Steel Company, it is reported, will soon install an electric furnace in a building on the Norcross property.

1,269,419. ELECTRIC SWITCH; Frederic P. Gates, Hartford, Conn. App. filed Aug. 25, 1915. Multi-circuit switches which may be employed to control the several lights of an electrolier group.

1,269,425. TELEPHONE HOOK SWITCH AND CUT-OUT; John T. Gray, Great Falls, Mont. App. filed March 4, 1916. An improved cut-out combined with the usual hook switch to be opened when the receiver is on the hook.

1,269,453. AUTOMATIC PARTY-LINE TELEPHONE-EXCHANGE SYSTEM; Alexander E. Keith, Chicago, Ill. App. filed Aug. 20, 1906. Telephone systems in which automatic switching machinery is under the control of the subscribers.

1,269,481. PROTECTIVE DEVICE; Howard D. Matthews, Schenectady, N. Y. App. filed Aug. 1, 1916. Relay devices of the reverse-power type.

1,269,485. ELECTROLYTIC STARTING-SHEET SUSPENDER; Henry S. Montgomery and Henry A. Tobelmann, Ajo, Ariz. App. filed Nov 13, 1917. An electrolytic starting-sheet suspender in which the ends of the suspender are slit longitudinally and secured to opposite faces of the sheet.

1,269,495. IGNITION SYSTEM; Frank M. Norris, Los Angeles, Cal. App. filed Jan. 17, 1917. Mechanism for igniting the charge in internal-combustion engines, known as "jump-spark" or high-tension" ignition.

1,269,499. SUPERVISORY CONTROL CIRCUITS FOR TELEPHONE SYSTEMS; Samuel Paterson, Kenton, Manitoba, Can. App. filed Oct. 17, 1914. Signal-control circuits for telephone exchanges employing magneto substations.

1,269,510. BULB FOR ELECTRIC HEADLIGHTS; James M. Richardson, Highland Park, Mich. App. filed Oct. 4, 1913. Provides a single incandescent electric lamp bulb having a plurality of separate filaments spaced apart therein.

1,269,520. MANUFACTURE OF INCANDESCENT LAMPS; Fritz Blau, Charlottenburg, Germany. App. filed April 18, 1916. Provides in the lamp a very efficient drying agent which will remove the water vapor in the lamp.

1,269,525. DEMAND MEASUREMENT; James R. Craighead, Schenectady, N. Y. App. filed Sept. 2, 1916. Demand apparatus for indicating or recording the demand made by an electrical installation upon a source of electric energy supply.

1,269,526. PROTECTIVE DEVICE; Elmer E. F. Creighton, Schenectady, N. Y. App. filed June 8, 1916. Devices for rapidly extinguishing an arc produced either by overvoltage or by the opening of a switch of the air-break type.

1,269,534. PROTECTIVE DEVICE; George F. Gray, Schenectady, N. Y. App. filed Feb. 3, 1918. Provides an improved lightning arrester of the vacuum type.

1,269,537. DYNAMO-ELECTRIC MACHINE; William E. Holcombe, Schenectady, N. Y. App. filed Jan. 8, 1916. Relates to the ventilation thereof.

1,269,538. ADJUSTABLE LAMP FIXTURE; Henry R. Huberich, Cleveland, O., App. filed Aug. 21, 1915. Means for adjusting the light source to various positions.

1,269,539. TELEGRAPH SYSTEM; Oscar M. Leich, Genoa, Ill. App. filed Feb. 9, 1917. Operates telegraph relays or sounders through the agency of a rectified alternating current.

1,269,542. ALARM FOR COMBINATION LOCKS; Floyd B. McNabb and Richard M. Skinner, San Francisco, Cal. App. filed July 31, 1916. Causes an alarm to be sounded whenever the knob of the combination lock is turned too far in either direction.

1,269,563. ELECTRIC SWITCH; Clark T. Henderson, Milwaukee, Wis. App. filed Sept. 14, 1914. Relates to electromagnetic switches called "series switches."

1,269,564. ELECTRIC SWITCH; Clark T. Henderson, Milwaukee, Wis. App. filed Sept. 14, 1914. Series switches in which a single coil operates the contacts.

1,269,565. PROCESS OF ELECTROCHEMICAL PRECIPITATION OF METALS; Edward R. Holden, Los Angeles, Cal. App. filed Oct. 10, 1916. Electrolytically treating solutions containing metallic substances.

1,269,566. ELECTROLYTIC APPARATUS; Archibald J. MacDougall and Guy N. Middleton, Toronto, Ontario, Canada. App. filed July 5, 1917. Electrolytic apparatus which continually changes the electrolyte in the zone of action.

1,269,590. COIL-RETAINING MEANS; Allan B. Field, West Cliff-on-Sea, England. App. filed Feb. 21, 1914. Adapted for use in connection with the overhanging end portions of coils in the rotors of high-capacity turbo-generators.

Record of Electrical Patents

Notes on United States Patents

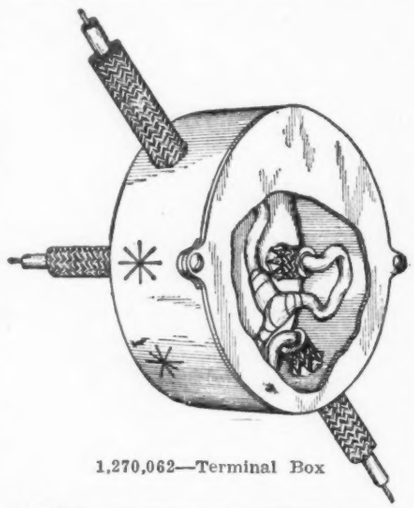
1,269,601. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Nov. 25, 1914. Relates to the automatic acceleration of electric motors that propel electric railway vehicles.

1,269,602. LOCOMOTIVE; Rudolf E. Hellmund, Swissvale, Pa. App. filed Oct. 30, 1916. Provided with a plurality of propelling motors having twin armatures.

1,269,611. PUSH-BUTTON SWITCH; John E. Ketteman, Toledo, Ohio. App. filed Feb. 24, 1917. Snap switch.

1,269,617. MULTIPLE SPOT-WELDING MACHINE; Joseph Ledwinka, Philadelphia, Pa. App. filed Jan. 10, 1917. Comprises a plurality of movable electrodes.

1,269,625. AUTO-STARTER; Walter O. Lum, Wilkinsburg, Pa. App. filed May 3, 1915. Provides a simple automatic means for successively establishing starting and operating connections.



1,270,062—Terminal Box

1,269,646. ELECTRICALLY HEATED CUP OR CONTAINER; William P. Robertson, New York, N. Y. App. filed Sept. 15, 1916. A device comprising a container, a metal-incased electric resistance element therein and tubular supporting members.

1,269,655. ELECTRIC SWITCH; William C. Stevens, Summit, N. J. App. filed April 4, 1916. Electromagnetic switches for motor control.

1,269,679. PRIMARY BATTERY; Menotti Bonora, Turin, Italy. App. filed Jan. 31, 1917. In a primary battery cell, an intermediate frame member without lateral walls and end frame members having lateral walls.

1,269,684. ELECTRIC SWITCH; James W. Cox, Wilmette, Ill. App. filed March 8, 1915. Provides a pair of stationary contacts and a pair of independently pivoted contact members.

1,269,702. MESSAGE-REGISTER CIRCUITS FOR MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEMS; Charles L. Goodrum, New York, N. Y. App. filed June 15, 1916. A set of repeating relays is installed before the first of a train of automatic switches.

1,269,712. EMERGENCY LIGHTING SYSTEM; John W. Jepson, Depew, N. Y. App. filed July 8, 1914. For electric motive power cars, where the regular lights are supplied with energy from the motive-power mains.

1,269,726. WELDING METALS; Ralph D. Mershon, New York, N. Y. App. filed April 3, 1917. A method of welding that retains the parts together in the position in which they are to be united, connecting them to one terminal of a charged condenser.

1,269,748. CONNECTOR; Ralph R. Root, Cleveland, Ohio. App. filed June 14, 1915. Comprises a sleeve-like body portion having socket slots in one end thereof.

1,269,770. METERING PANELBOARD AND CABINET THEREFOR; William Wurdack, St. Louis, Mo. App. filed Aug. 11, 1916. Inclosing cabinet and a panelboard mounted securely within the cabinet.

1,269,776. STEERING-WHEEL HEATER; William P. Barton, Salt Lake City, Utah. App. filed Aug. 2, 1916. A heating element for steering wheels consisting of a resistance wire and an asbestos covering.

1,269,778. STORAGE BATTERY; Julius Becker, Chicago, Ill. App. filed May 22, 1916. The combination with a cylindrical container of an active element within the same.

1,269,784. CIRCUIT COUPLING FOR ELECTRICAL APPARATUS; Frederick E. Carlson and Joseph F. Lamb, New Britain, Conn. App. filed May 24, 1916. A hand portable electric utensil, resistor terminals and a binding post electrically connected to one of said terminals.

1,269,806. TIMER FOR GAS ENGINES; Harold J. Gerpheide, South Bend, Ind. App. filed July 11, 1917. Relates to timers wherein the wire leads to the fixed contacts are arranged exteriorly of the timer.

1,269,838. DIRECTION-INDICATING SIGNAL FOR AUTOMOBILES; Floyd N. Moore, Peoria, Ill. App. filed April 14, 1917. In a signal, a casing having an opening in one side and a clear glass pane covering the opening.

1,269,856. ANNUNCIATOR; Adolph Rendle, New York, N. Y. App. filed July 19, 1917. Relates to signal systems for hotel by means of electric lamps.

1,269,889. IGNITION APPARATUS FOR USE WITH INTERNAL-COMBUSTION ENGINES; Sidney J. Williams, London, England. App. filed June 12, 1916. Comprises a source of electric energy and a trembler and primary coil in parallel with a non-trembler coil.

1,269,891. CURRENT RECTIFIER; Fred Woodside and Doss Wright, Dillon, Mont. App. filed Sept. 28, 1917. Adapted to the rectification of an alternating current into a direct current and may be employed upon self-propelled vehicles.

1,269,896. ELECTRIC LOCOMOTIVE; George C. Abbe, Lansdowne, Pa. App. filed Nov. 9, 1917. An electric locomotive in which the guiding wheels are entirely dispensed with.

1,269,903. MEANS FOR CONNECTING ELECTRIC LINES; Leonard C. Bygrave, London, England. App. filed Nov. 22, 1916. Devices for establishing connection between two groups of lines are effected by relays.

1,269,909. ELECTRIC MOTOR; Thomas L. R. Cooper, London, England. App. filed Feb. 20, 1918. An induction motor, adapted to be used under water, comprising a stator, with field windings, and a rotor in which the currents are generated by induction from the field.

1,269,913. ORGANIC-MANGANESE-COMPOUND DEPOLARIZER; Carleton Ellis, Montclair, N. J. App. filed Oct. 18, 1915. Depolarizing material for use in galvanic cells of the Leclanché type.

1,269,916. POLYACID-OF-MANGANESE-DIOXIDE DEPOLARIZER; Carleton Ellis, Montclair, N. J. App. filed Jan. 17, 1917. Relates to a depolarizing agent or galvanic cell of the Leclanché type employed in pocket flashlamps.

1,269,917. CONTACT FINGER; Oscar S. Field, Elizabeth, N. J. App. filed Sept. 30, 1916. Contact finger of clamping plates, a contact spring and means comprising insulating studs.

1,269,919. RAILROAD SIGNAL; Edgar Foster, Vicksburg, Miss. App. filed Sept. 16, 1916. Means for automatically closing an electric signal circuit.

1,269,926. RUST PREVENTION; Carlos I. Gesell, Mamaroneck, N. Y. App. filed Jan. 7, 1918. Utilizes the protective agent which an electropositive metal to iron creates.

1,269,954. ELECTRIC LIGHTING SYSTEM AND CONTROL; Omar I. Nigh, Washington, D. C. App. filed March 2, 1916. Provides a duplex electric lighting system for motor-driven vehicles.

1,269,992. METAL VEHICLE WHEEL; Harry R. Woodrow, New York, N. Y. App. filed Oct. 19, 1917. A method of electrically welding together the spokes and flange plates of a metal vehicle wheel.

1,269,996. METER AND INSTRUMENT SUPPORT; Percy H. Bartlett, Philadelphia, Pa. App. filed Nov. 14, 1917. Meter support and an inclosing box adaptable to meter casings.